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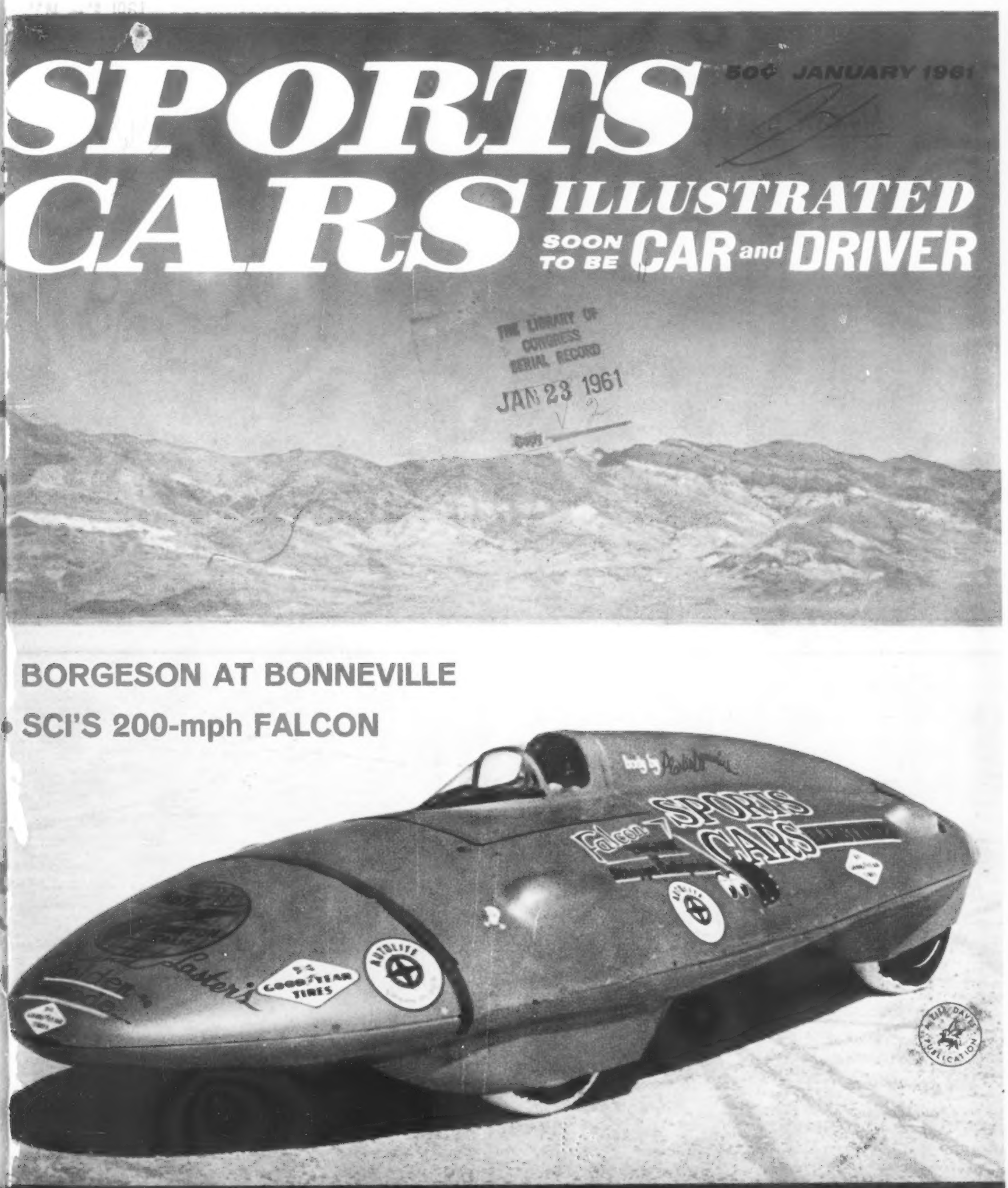

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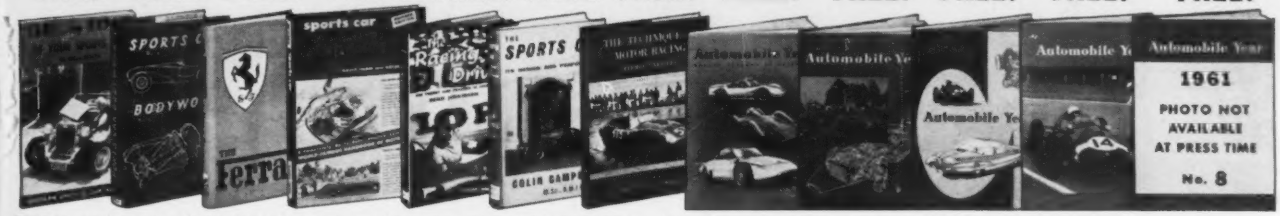

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SOON TO BE CAR and DRIVER

January 1961
Vol. 6 No. 7

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Bill Burke's fantastically fast Ford Falcon-powered streamliner sits for its portrait for, appropriately enough, this month's cover of Sports Cars Illustrated.

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OBSERVATION AND OPINION

EXCITING OBSERVATIONS—Seldom have we been so excited by a piece of material as by Jesse Alexander's interview with Phil Hill, beginning on page 37. Phil's naturally introspective and penetrating attitude toward racing has produced some provocative insights into the nature of Grand Prix racing today and the stark realities faced by the men who drive the world's fastest road racing cars. Most intriguing, we thought, were the results of Ferrari's comparison tests at Zandvoort between the front-engined and rear-engined single-seaters. Traditional opinion, of course, has always held that the driver should sit as far back as possible to get the maximum "feel", the usual negative example being the prewar Auto Unions with their big rear engines and far-forward drivers who — it was said — were thus severely handicapped.

In the Thirties, though, it was certainly true that the main driving problem was keeping the rear wheels in line with the rest of the car — coping with the massive power (500 to 650 bhp) the cars of that time possessed. Nobody was much interested in using every last shred of cornering power at all four wheels, so it was only important that the driver know what the *back* tires were doing. Today, when vast advances in suspension have increased lap speeds in spite of a reduction in G.P. car power, the driver desperately needs to know what's happening at all four corners of his car; he's just as likely to lose control at the front as at the back. In this light, it makes superb sense to seat the driver smack in the middle of the car, where he gets a true picture of its overall behavior. As Phil Hill points out, if you're at one end only you get a very inaccurate view, and sometimes the car moves so violently — especially at the back — that you can lose your orientation completely! There's much more to the present-day supremacy of the rear-engined racing car, but this is certainly a major consideration.

WORLD OF WANKEL—Not long ago NSU released a photo of its latest experimental Wankel engine, on the occasion of the fiftieth birthday of its technical director, Viktor Frankenberger. This unit is the largest yet built by NSU, at 400 cc, and it clearly shows the results of painstaking refinement and careful design for production. You'll see that a neat angled shaft drive has been built into the front cover plate to serve the distributor and oil pump, and that the water pump has also been integrated with the housing.

One of our European spies reports this engine has been fitted to a Sport Prinz, using "somebody else's transmission" which keeps them from reaching more than 5000 rpm in top gear, but that this is equal to 93 mph — a dozen more miles than the 583 cc stock Sport Prinz can deliver. Though they've revved the engine to 12,000 in the lower gears, they're now basing development on a peak speed of 6000 rpm, at which the 400 cc unit gives 45 to 50 gross horsepower for an engine weight of 50 pounds (cast aluminum trochoidal housing with chromed running surface.) Exhaust back-pressure has posed unexpected problems, though: as-installed power, with full muffling, is only 35 to 40 bhp, on the same level as the Sport Prinz twin. The long intake pipe shown indicates lots of attention to ram tuning, though NSU says this was for installation purposes only.

Now under new direction, Curtiss-Wright is reappraising all its far-out engineering programs, leading to a temporary suspension of development of its version of the Wankel engine. It's done a lot of the preliminary work on a mammoth 1000-horsepower unit, but whether this has ever run is not certain at this time. If C-W isn't interested in carrying the project further, other U.S. manufacturers definitely are. And NSU is already building a new factory exclusively for Wankel engine production. —*Karl Ludvigsen*


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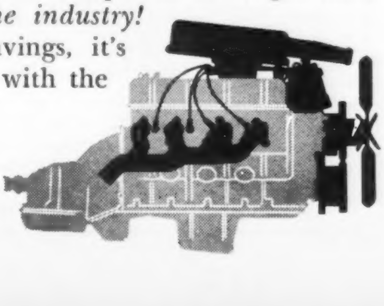


LETTERS

SNOB

I have just purchased my last copy of SPORTS CARS ILLUSTRATED. I patronize the sports car publications because of my interest in *pure* sporting machines.

On page 27 of your October issue was an article on the new Pontiac; if I wanted any scoop on this car, I would have bought MOTOR TREND. On page 42 was an article on Go-Karts; for this there is KART magazine. Page 60 carried a nauseating story on dragsters; the place for such trash is HOT ROD magazine.

Let's try and stay with sports cars or change the name of the magazine.

Peter W. Brenzel
Yonkers, New York

We feel Mr. Brenzel's use of the word "patronize" perfectly suits his attitude toward automobiles. SCI always has and always will be edited for men with a sincere interest in exciting cars, not for narrow-minded dilettantes. Change the name? Be sure to pick up your first copy of CAR AND DRIVER *in April!*

ANTI-SNOB SNOB

You sports car snobs nauseate me. My Chrysler 300F can, and does, run rings around every bit of foreign junk I've seen — including the much-sanctified Mercedes-Benz 300SL and similar exotics. Not only that, but it does it with four people on board, a trunkful of luggage and in the cool comfort of air conditioning. Nor must I buy a garageful of metric tools, put up with incompetent mechanics (and outrageous repair prices), approach a long trip with trepidation, or join a sports car club to support a well-developed inferiority complex by sneering at domestic cars. If you've ever been to Europe, you'll find out they think quite a bit of American cars over there.

I realize you people have quite a vested interest in the sale of foreign cars in this country and this letter will probably end up in File Thirteen, but to you exponents of "motorized pup tents," I'll bet there might be a sneaking suspicion that the most versatile, dependable and best all around automobiles are made right here. Though I know you'd lie down in the road and be run over by a Jaguar before you'd admit it.

For the record, I once went out on a limb and bought a sports car, an MGA, in 1958. To paraphrase a famous saying, "Never before in the course of automotive history has one person had so much trouble with one car," to say nothing of trying to put the top up (I now push a button), or trying to outdrag a Rambler (it didn't look so sporty to my friends when the Rambler pulled away), or practically having to have the fillings in my teeth reset after a little drive on a bumpy road (NOBODY can say an MG rides well), or trying to keep the little thing tuned up.

Three of my friends are also former-and-never-again foreign car owners. We agree that for all-around driving (especially dusting off sports cars), you can't beat the American car — especially the 300F.

So why don't you iconoclasts start being a little intelligent? Go ahead — break down and step into an American car, take a drive and be honest with yourself — if not with your readers. They are good cars and the 300F will wipe off that Ferrari smirk on your face. If you don't believe it friend, well, just try it.

O. A. Gillen
Shreveport, Louisiana

Not even Chrysler in its wildest imaginings would claim that a 300F could out-corner or out-brake **any** *good sports car, let alone one of the best — the 300SL. To be sure it goes like hell in a straight line, even with Mr. Gillen's four people, luggage, and air conditioning (on a convertible?) But, bumpy ride or no, the only rings that will be run will be by that MGA whenever the road gets interesting.*

IS IT FEATHERBEDDING?

Mr. Gordon's four points (John F. Gordon, GM president, commenting on the annual change, Detroit Newsletter, October) moved me to the quick.

Point One — "The annual model change promotes competition among designers and engineers." Who is going to break the sad news to all the Volkswagen and Renault owners that since these plants don't have annual model changes, they must not be engaging in technological competition?

Point Two — "The annual model change generates sufficient additional sales to pay for itself." I don't believe it.

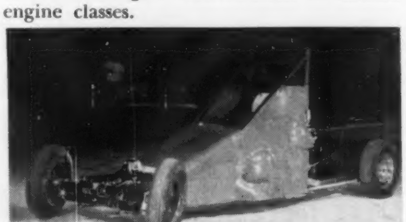
Point Three — "The annual model change makes used cars available. . . ." This is the most hideous slander of all. If there were no annual change, cars would cost less and depreciate less. Thus the lower annual cost of ownership would allow most of those who now buy used cars to buy new cars.

Point Four — "to create . . . thousands of new jobs. . . ." I'm glad the high price I pay for a new car goes to keep some poor factory hand at his job. Say — this isn't that terrible "featherbedding" I've heard so much about?

Michael V. Mahoney
Bend, Oregon

DRAGGING THE WEE 'UNS

Here is a photo of 18-year-old Tom Ordway's "Leastest Inch" dragster. As pointed out in your October issue, timing associations should give consideration to smaller engine classes.



The vehicle pictured *(which combines in concept the dragster and the kart — Ed.)* has made runs at 13.1, 13.2 seconds and 101 mph. Recently, it broke the 13-second mark only to throw a wheel and flip at well over 100 mph.

(Continued on page 8)

(Continued from page 6)

The interesting thing is that all this is done with a revamped twin Triumph engine of about 40 to 45 cubic inches in a vehicle weighing about 450 pounds. Tom, incidentally, does all his own machine and engine work.

With a quick-shift setup, he takes no sass from the big-inch stockers. And what is he paired off with? The rules say Class C, 303 cubic inches and under! They run him against a 1930 Plymouth four which has a best time of about 66 mph through the traps. It would be just as bad if he went against the Sprites, etc. According to the rules, if he installs a blower, that advances him one class—Class B, over 303 cubic inches.

To get around such foolishness, we are designing a new chassis to mount two twin Triumphs. Presently Tom comes off the line at 6000 rpm and peaks at 8000; we feel 10,000 is not out of the question. We plan to use aircraft techniques, such as magnesium tubing and extensive streamlining.

We hope SCI will continue to promote classes for small displacement engines if only to bring more competitors into these classes.

James O. Brier
Hawthorne, California

GAS MILEAGE VARIES

In your road test of the Jaguar 3.8 (SCI, September), you quote a gas mileage of 13 to 19 miles per gallon. ROAD & TRACK, testing a similar car, specified a range of 17 to 23 mpg. Please explain this discrepancy.

Charles A. Brandt
Chatsworth, California

Just as we quoted the mpg our test car delivered, we are sure that R & T accurately quoted theirs. All too often, there is a wide spread in performance of apparently identical cars, both in acceleration and in gas mileage. In testing cars for readers' benefit, we can only report the results we obtain with the cars we test. Our contemporaries do the same, we are sure. When, in our experience, the results seem out of line with our expectations, we return the car to the owner so whatever fault is present can be eliminated. In this case, the mileage, while disappointing, was not extraordinarily so, considering the impressive acceleration of which the Jaguar is capable.

Also to be kept in mind is that cars tuned for maximum performance are generally set a little on the rich side while economy-minded owners will sacrifice a fraction of their potential power by running slightly lean. (Lean mixtures burn hotter than rich ones.)

SURTEES SIDELIGHTS

On behalf of the motorcycling fraternity, I most heartily concur with Dennis May and his splendid story on John Surtees' (September, 1960) impending transition from motorcycle racing to auto racing.

In June of 1959, I experienced the thrill of accompanying John Surtees on two laps of the Isle-of-Man T.T. circuit with John at the wheel of my Porsche Super coupe and John Hartle acting as co-pilot. Although we did some fairly rapid motoring at various times, this was the one and only time in my life that I can recall riding in my own car with someone else at the wheel,

(Continued on page 79)

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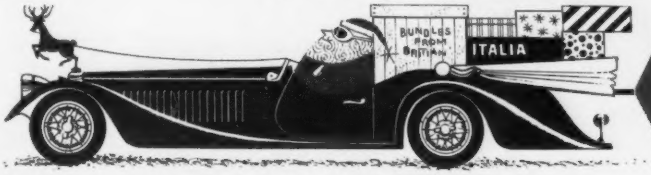

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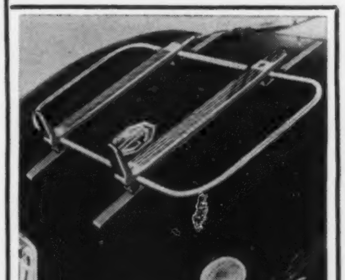

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PIPELINE

Huh? That says Pontiac Bonneville Vista? Yes indeed, states Pontiac's press office. It's a replica of the sign placed on their car during the **American Exhibition in Moscow** a year ago. At least we don't *think* it

says Dirty Capitalist. Our favorite Pontiac sign though was seen at Cape Cod this summer. What with one labor trouble after another, now the factories are going to have to check spelling ability. At least one Ventura got out labeled Ventira.

When SCI speaks, the World stops and listens. Or is it that others have the same ideas we do? Anyway, Jack Brabham has fitted a single-cam 1220 cc **Coventry-Climax engine to his Triumph Herald coupe.** Brakes and suspension are modified to suit the performance, which onlookers stated was "astounding."

An **under-$3000 personal car** is in the works at the Seagrave Corporation, known for 75 years for its fire apparatus. Three cars have been built and are running, but production details were still in flux at this writing. Body styles includes a convertible, a two-door four-passenger coupe and a two-passenger coupe.

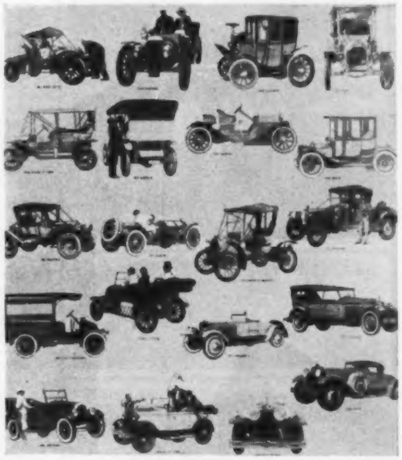
Powered by a four-cylinder 65 bhp Continental engine, top speed is 75 to 80 mph. Options will be offered in choice of transmission — either automatic or manual. Two of the existing cars have been built of fiberglass and one is aluminum.

Plans and rights to the car were acquired from a Detroit corporation. With a 93-inch wheelbase, and a 58-inch tread, the car stands a scant 48 inches high and is 13 feet long. Fuel capacity is 11 gallons. Autolite electrical components and Stewart Warner instruments are used. The 1700-pound car has a 19-cubic-foot trunk. The Seagrave Corporation has headquarters at 122 E. 42nd Street, New York 17, New York.

Ecurie Pierre, Dept. S, 1805 S.E. 50th Avenue, Portland 15, Oregon is manufacturing **sway bars** for the Sprite, Morris and Triumph at $19.95 each and for the MGA at $23.95. . . .

Wide, sheepskin-lined **shoulder harnesses** featuring a metal-to-metal quick release lever may be ordered from Bob Stewart, Dept. S, 15610 Thatcher St., Detroit 35, Michigan. All of the belts are custom-made.

Marking the 100th anniversary of the petroleum industry, the Quaker State Oil Refining Corp., Oil City, Pennsylvania recently **sponsored a rally,** donating 32 trophies to drivers and navigators of winning cars. The best score of the day was achieved by Mr. and Mrs. Walter Larson, of Fairview Park, Ohio who drove their Alfa to victory over 82 other entrants. . . . In addition to supplying trophies, Quaker State also provided gas and oil for the cars. The rally was held under the auspices of the Mahoning Valley Region of the SCCA. . . .



The **good old cars** of the good old days is one of 31 subjects available on 25-by-37-inch posters at Poster House, Dept. S, 4 Country Club Drive, Chatham, N. J. Single posters (cars, bullfights, travel, etc.) cost $1.50 each while for four or more the price is $1 each.

A travel bag featuring a see-through map pocket and four partitions comes in black or red morocco at $17.50 or pigskin, at $22.50. It's available at Mark Cross Co., Dept. S, 707 Fifth Avenue, New York. . . .

Bakers Worldwide Auto Parts, Inc., Dept.

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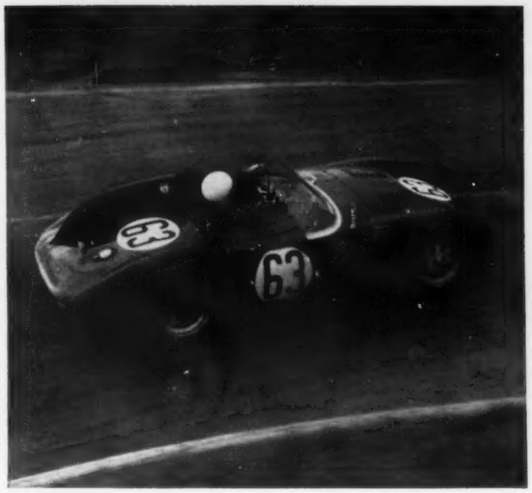
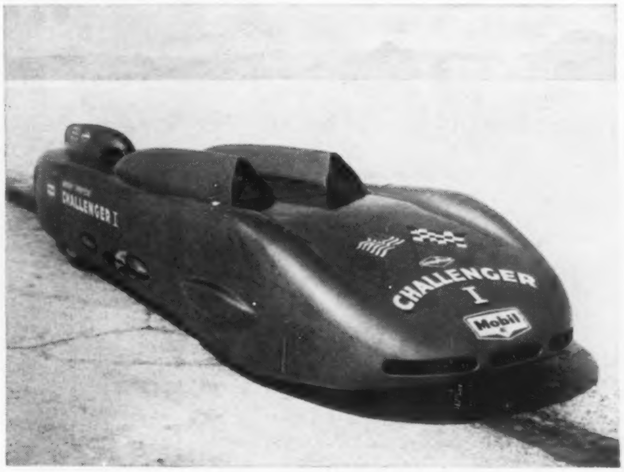


SEBRING—10 out of 14 class winners used Champions—including the OSCA (above) that won the coveted "Index of Performance" trophy. Champion-sparked class winners included a Corvette, Porsche, Ferrari, Fiat, Fiat-Abarth, Sprite, DKW, OSCA and Lola.

PIKES PEAK—Records fell at the Pikes Peak Hill Climb, too. Lou Unser set a new stock-car record in his Champion-equipped '60 Pontiac, while the Championship Car class was won in record time by Bobby Unser. His Unser Special used Champion spark plugs.

BONNEVILLE NATIONALS—At the 1960 meet, a new two-way speed record for standard stock cars was set by a Champion-sparked '60 Ford, driven by Karol Miller. The fully equipped Ford averaged 157.902 mph over the salt. 18 new records were set with Champions at the Nationals.



HISTORY'S FASTEST CAR—On September 9, Mickey Thompson became history's fastest driver as he drove his Champion-sparked Challenger 1 over the Bonneville Salt Flats at 406.60 mph . . . a new one-way Land Speed Record!

CHAMPIONS SPARK THE WINNERS!

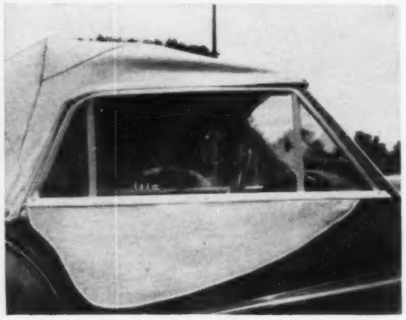
It's not just racing that proves the superiority of Champion-sparked performance. Countless billions of miles on turnpikes, highways, city streets and side roads have proved to the engine experts who build the world's cars that you can't beat *Champion* performance. That's why 46 of the world's car manufacturers use Champion spark plugs. That's why you should use Champions in *your* car.

DEPENDABLE
CHAMPION
SPARK PLUGS

COMPANY • TOLEDO 1, OHIO

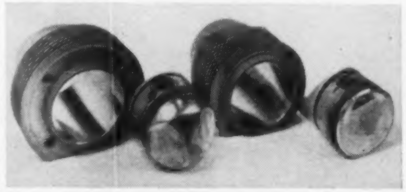
(Continued from page 10)

S, Franklin Square, L.I., New York offers windows that slide up and down and are said to **eliminate bowing at high speed.**

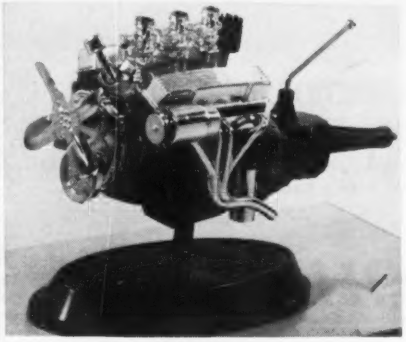


They cost $89.95 the pair. . . . If your taste in cars leans toward A.C.s, you'll be pleased to hear an American Center of the **A.C. Owners Club** is forming . . . and you don't even need to own one to belong . . . contact Ed Sissman, Box 107, Still River, Massachusetts. . . .

Market Forge, Dept. S, Everett, Massachusetts, the oldest **luggage rack** constructor in the country has some available for compacts and imported sedans. . . . Rebuilt



cylinder and piston assemblies for the Porsche are marketed by Ward Hard Chrome and Engineering, Inc., Dept. S, 124 Hegenberger Loop, Oakland, Calif. Normal and Super sets cost $180 while those for the Carrera and Spyder are $220, both prices are on an exchange basis. . . .



Looks like the real thing . . . a 7½-inch long, 5-inch high **model of a Chev V8** contains 135 parts of molded plastic, including those to customize it for street, show, drag strip or racing. All of the parts snap together and no painting's needed. The kit, complete with an electric motor, stand and 16 page engine customizing book, is available at $4 from Polk's Hobbies, Dept. V, 314 Fifth Avenue, New York 1, New York.

Admittedly facing a period of "sharp competition" with compacts and other imports, **Renault, Inc. has announced policy changes** of interest to prospective buyers. These include price reductions and a

(Continued on page 16)

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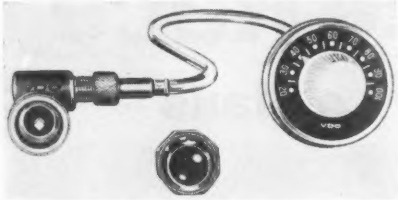
liberalization of the existing six-month warranty policy for parts and service. Dauphine **prices have been cut** from $50 to $71 while Caravelles now carry price tags that have been slashed by $150 to $171.

Other moves include stepped-up development of nationwide parts distribution, a cut in prices of replacement parts and introduction of a station wagon and pickup truck. . . .

A speed warning device would make a **nice accessory for the lead-footed driver** . . .



it could, conceivably, pay for itself in speeding ticket savings. Priced at $18.95, it will fit most any car, and for $21.95, you get the warning unit equipped with an extra buzzer and switch. Together with a Sparkometer to indicate the most economical driving range ($18.95 rear engine; $17.95 front engine) it's available from VDO Instruments, Dept. S, 4475 Cass Avenue, Detroit 1, Michigan.

Twelve veteran cars that made automotive history between 1904 and 1915 are described and illustrated in "Early Motor Cars," by George A. Oliver published in a limited edition by the Stephen Green Press, Dept. S, Brattleboro, Vermont. Priced at $20, the book measures 14 by 19 inches, features color plates and scale drawings. . . .

A free booklet, **"The History of Safety Helmet Research,"** is available from the Joseph Buegeleisen Co., Dept. S, 21220 West Eight Mile Rd., Southfield, Michigan. The firm makes **Buco** safety helmets. . . .

The second annual south-of-the-border bash for Karts has been announced by Jerry Bielke, 1512 Stuart, West Covina, California, promoter of the 1960 International **Grand Prix De Tecate Kart Race** (October SCI). The dates are May 19, 20 and 21, with the races to be run over the same course as last year. . . .

You say you've been spending too much time at the races and not enough improving your mind? Here are a few **current titles** you might want to curl up with. . . .

Another in the line of the Modern Sports Car Series (Sports Car Press, $1.95) is **"The Sports Car Club — How To Join or Organize One,"** (126 pages) and a much-needed addition it is, as the SCI editorial office can attest. Granted that sports car clubs are often most happily organized by three guys over a bottle of beer (or three bottles), this book answers a lot of the pesky questions that arise in the cold light of sobriety. Its author, John C. Rueter, covers events and organization, with some very direct pointers for the neophyte shopping around for a club, as well as for the clubs themselves (like please, fellas, when you elect a new secretary notify everyone of your new address!) Those who need it will appreciate that it's written from the point of view of the innocents themselves and doesn't assume that of course they know all sorts of preliminary matters.

One small point: both gymkhanas, for example, and club infighting are a little hairier than they're made to appear. Trends in club events change pretty quickly, and puncturing balloons at high speed, or even backing in a tight circle, has given way to something a little more demanding for both car and driver. But on the whole this is an extremely helpful and sensible book for the beginner . . . and may even inspire the lady who would rather stay home on Sunday afternoons . . . and there are many.—*SB*

The 1959 running of Le Mans saw Aston Martin cars niche an overall win after nine hard years of searching for victory on the Sarthe circuit. That much is history and is well known by sports car enthusiasts. What's not known is how the big green cars from Feltham managed to do it against the potent Ferraris.

In his book, **"Le Mans,"** Stirling Moss presents a straight-forward account of the team approach, Aston Martin's "secret weapon" for Le Mans. He presents drivers' views of the sports car race most liked by European spectators and most disliked by the drivers themselves. It would seem that the main reason for participation in the 24 hours is the publicity value attached to winning. Yet, the Aston Martin victory should not be minimized in view of the painstaking attention to detail and the previous near-misses that preceded it. It deserves being immortalized in print. This being the case, it seems a shame that Mr. Moss's rather casual text seems more appropriate to an expanded magazine article rather than a full-blown hard cover book. "Le Mans," by Stirling Moss with Maxwell Boyd, is published by Hanover House, Garden City, N.Y., has 128 pages and costs $3.95. —*HW*

DETROIT NEWSLETTER

by Roger Huntington

Results of the stock car run-offs at the recent National Hot Rod Association championship drags suggest that auto enthusiasts need look no farther than Detroit to find the most powerful passenger car engine in the *world* today – notwithstanding big-inch Ferraris or any other foreign iron.

I refer, of course, to Jim Wanger's winning "super-stock" 1960 Pontiac with the maximum-performance equipment package. This included the optional triple-two-throat carburetion, special cylinder heads with 10.75 to one combustion chambers, 2.0-inch intake valves (1.88-inch is standard) and 1.65 to one rocker arm ratio, solid-lifter hot cam kit with double valve springs, special distributor, and beautiful cast streamlined exhaust headers with dual outlets for each bank routed for 360-degree firing order in each outlet. The factory rates this package 363 bhp at 5600 rpm, but Wanger's performance on the track – accelerating his 4100-pound two-door hardtop from a standing start to 100-102 mph in 1320 feet – indicates a true output of *at least 400 horses at the clutch!* His elapsed times, using a drive line combination of the optional 4-speed transmission and 4.88 to one rear-end gear, ran between 14.10 and 14.28 seconds! He shifted between 5800 and 6000 rpm and crossed the finish line at 6100. The engine never missed a beat through the whole ordeal. (For this we can credit engine masters Frank Rediker and Win Brown at Royal Pontiac in Royal Oak, Michigan, who set up the car.)

IMPROVING THE BREED

I wonder what our auto enthusiast friends are thinking about a recent statement by a prominent Chrysler Corp. engineer that car development through racing research is a waste of manpower and money? This was the observation of Otto Winkleman, who was director of research for Daimler-Benz in the mid '30s (at the height of their Grand Prix program) and is presently on the Chrysler staff. He should know what he's talking about. Winkleman says it's very difficult to apply technical lessons learned on the race track to the development of utility passenger cars – and, just as important, no company has enough engineering brainpower available to do the best possible job on both the racing and utility cars. One or the other always suffers. He says developing passenger cars through racing is "like breeding cats to find a way to breed better dogs. It is much better to experiment directly with the dogs."

I only mention this to point up the difference between out-and-out racing development and the kind of performance development that results in cars like the 363-bhp Pontiac mentioned earlier. The latter development is comparatively inexpensive, requires few engineering manhours, and the finished equipment can be sold directly to the public. Furthermore, a relative handful of these high-performance optional models winning races on our nation's drag strips and stock car race tracks can influence thousands of sales in that important segment of the market where the buyer is looking for *more* than just utility transportation. These people may not want to ride around in a solid-lifter floor-shift Pontiac with a 4.88 rear end; but a winning performance record by the Pontiac make in general may influence them to buy a Pontiac instead of a Dodge or Mercury. Manufacturers didn't use to think this "youth market" or whatever you want to call it was an important factor in the profit picture (especially since Ford had it sewed up tight anyway from 1932 to 1955!). But now the whole low-priced field is *competing* for it. Look at the experience of Royal Pontiac, who sponsored the winning super-stock at the NHRA Nationals. They specialize in high-performance Pontiac models and optional equipment, and they've sold over 300 of these cars in the Detroit area this year! Performance has put a lot of black ink on Royal's books in 1960.

The "factory hot rod", then, is the American manufacturer's answer to the need for sound performance development – not multi-million-dollar hand-built teams of Le Mans or Grand Prix challengers. The chances for anything like this out of a domestic factory in the next few years look pretty remote.

SAFER ROADS

Some important people in the U.S. auto industry feel we could do as much for safety through *road* design as through *car* design. This was brought home by a recent SAE paper from K. A. Stonex, assistent director of the GM Proving Grounds, describing their scientific analysis of the highway safety factor, and how these findings were being applied in the re-building of roadways on the corporation's test grounds in Milford, Mich. They analyzed such things as the impact strength of signpost mountings, optimum height of guardrails, maximum desirable g. load when a car runs diagonally into a ditch at 65 mph, relation between ditch slope angle and side traction forces on different surfaces that will "trip" a car and tip it over, etc.

Some of the findings that are presently being applied on the Grounds: where speeds above 40 mph are involved there will be *no* obstacles (trees, signposts, drainage structures, etc.) for 100 feet on both sides of the road. Roadside slope will be 16 to 1 for the first 10 feet, then 6 to 1 for the next 10. The drainage ditch will be 14.5 feet wide, struck on a radius of 40 feet, with a 6 to 1 up-slope on the far side. This would give a maximum upward acceleration of .5 g. if a car hit it at 65 mph at a diagonal angle of 15 degrees, with a minimum of roll-over danger.

GM officials admit that such roadside construction costs considerably more per mile of highway than conventional construction. But they feel the reduction in the cost of accidents would repay the difference in two or three years. (It is

(*Continued on page 20*)

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reliably estimated that the cost of auto accidents now runs the equivalent of 12.5¢ per gallon of fuel burned!) The new construction has already mimimized several serious crashes on the GM Proving Grounds. All this is interesting new thinking on a subject vital to all of us.

ANOTHER ALUMINUM ENGINE

It looks like Chrysler will follow the American Motors lead in using high-pressure die-casting for its aluminum engine blocks instead of GM's semi-permanent-mold method with gravity feed and sand cores. They have been in low-volume production for several months on aluminum blocks for the slant six engine, using two huge casting machines at the Chrysler foundries in Kokomo, Indiana. Chrysler is using 8 percent silicon in the alloy, compared with 12 percent for the new A.M. job. They expect to install 20,000 of these blocks in 1961 Plymouths and Valiants, or about one out of 10 going down the assembly line. Customers can order the aluminum engine at no extra cost. (The head and manifold will still be cast iron, of course.)

So there's another hat in the aluminum ring. There's no question now that aluminum is the auto material of tomorrow, but there remains a lot of sweat and midnight oil to be expended in figuring the best ways to *fabricate* it.

NO TOGETHERNESS AT GM

The differences in the design philosophy among the various GM divisions — rather than the many similarities — are often intriguing. The "autonomy" of each division, expressed in very individualistic design, production and merchandising practices, is possibly the most important difference between GM and the other two large corporations, Ford and Chrysler. The latter two are like big, happy families — each division working with the others, sharing common components, engines, even design concepts — with the sole idea of out-selling the other *corporations*. In this case it's Ford Motor Company against the world, or Chrysler Corporation against the world. But GM is more like five individual corporations battling the industry *and each other* — like Buick against the world and Chevrolet against the world! More than one observer has credited this philosophy with GM's effecting long and consistent success in the competitive U.S. auto industry.

An interesting case in point is frame design for 1961. At first glance it would seem, since the various GM divisions share many common body panels and even complete shells, that it would be smart to standardize frame design between the divisions so common floor pans could be used. John Q. doesn't know anything about frame design, so this shouldn't be harmful from the public relations angle. But the division engineers are stubborn, and very individualistic. Basic types of frame layouts have shrunk from three in 1960 to two in '61; but GM is a long way from standardizing this factor yet. Cadillac, Chevy and Buick now use the massive X frame layout, without side rails, with step-down floor wells in the rear compartment and higher door-level floors in front. Olds and Pontiac, on the other hand, use wide-spread box frames with the side rails running out-

side the floor area — with step-down floors in both front and back. Olds uses no cross member along the length of the floor; Pontiac uses a small tubular member to support the rear of the transmission. Advantages and disadvantages of the two basic layouts are obvious: Cadillac, Chevrolet and Buick get superior frame stiffness; Olds and Pontiac get more floor room. It would be difficult to say who is right; the significant thing is that they're different.

There are many other examples we could cite where GM divisions could save money by more use of standardized components, without having the similarities obvious to the buyers. Why they don't do more? . . . well, these are things that make the observer's life so interesting!

'61 STYLING

It's time for me to add my two cents' worth on the new-model body styling. Here it is for what it's worth: GM has completely missed the boat on the new big-car bodies. Pontiac seems the best-looking and Olds and Chevy the worst — but none of them do much for me. GM's compacts are much better — and, in fact, I think the new Tempest, with its 15" wheels, graceful side molding and gull-wing grille, is the best-looking car to come out of the U.S. industry in five years. Ford ruined a nice body when they radically face-lifted the '60, and of course this applies to Mercury. The radical styling of the new Lincolns and Thunderbirds does nothing for me. Chrysler has improved things 100 percent with the '61 face-lifts, getting rid of the big fins, etc. Their body styling is now competitive with Ford and GM — and, in fact I see Dodge as the best-looking big car this year. American Motors and Studebaker have improved with their new restyling, but don't pretend to be in the same class with the big corporations that can afford to scrap body dies every two or three years. They would starve if all they had to sell was style. And now I've got that off my chest!

PLUG-IN ROAD TESTER

I guess nothing is sacred anymore — not even the stopwatch and fifth wheel in the road-test field. Most of our big auto companies are doing much of their performance and fuel economy evaluation these days on *electronic computers*. They find they can evaluate the effect of such changes as gear ratio, weight, streamlining, compression ratio, carburetor metering and spark advance much more quickly and easily this way than out on the test track with the old stopwatch, fifth wheel and fuel flow meter. Ford engineers say they can predict performance figures within 5 percent using production power train components with known characteristics, and they can come within 7 percent on future designs with estimated characteristics! It's just a matter of deriving a series of mathematical equations to describe the performance of the car on the road, inserting constants of sufficient accuracy to cover the characteristics of the particular components used, set up the equations on punched cards and tape for programming in the computer . . . and ZIP, ZIP — you've got your answer in minutes. None of this was practical in the old days of slide rule calculations because of the many skilled man-hours required.

And I suppose the day is coming when computers will do our *driving* for us! —*RH*

1960 INDEX

Listed below are gems of information, adventure, or humor that you may have missed in 1960. For back issues, send 50¢ for each issue wanted to SCI at 434 South Wabash Avenue, Chicago 5, Illinois.

ROAD RESEARCH REPORTS

ROAD TESTS

MEN AND CARS

FEATURES

HOW TO

TECHNICAL

COMPETITION

For the man a kart is the racing sports car in miniature he always wanted to own. For the woman it is the chance to experience driving thrills in a new sport where (because of lighter weight) she is often superior to the adult male kart driver. To children driving a kart is perhaps the greatest single thrill they will ever know because karting duplicates every big car condition in miniature; skids, slides and all types of control situations that few adult drivers ever get the chance to experience. To the teen-ager, racing a kart is a fine "safety valve" because he will get the sensation and mental stimulas of great speed but without the danger. He will be a much more skillful and safer big car driver because of it. Karting has become the world's No. I motorized family fun sport because when Kart driving is confined to backyards, kart tracks or off-street driving it is as safe as golf or roller skating.

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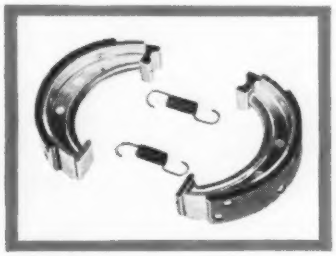

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EUROPEAN NEWSLETTER

A Farina-bodied Fiat-Abarth in October earned one world's record and eight international Class G titles at Monza.

Using a 90 bhp 982 cc engine, the car beat Ford's 1956 Bonneville records by driving 72 hours straight at over 115 mph. The class records broken included some formerly held by Abarth, BMC and DKW. The runs were held during bad weather and a gust threw the car into the wall while traveling at about 120 mph. Maglioli, the driver, was unhurt, but it took over a half hour to fix the damage.

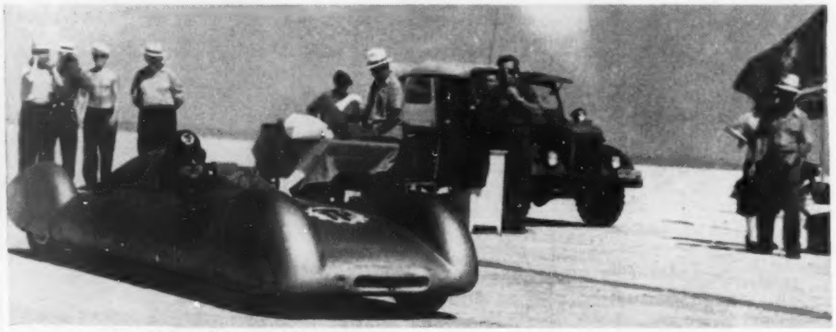
Saab is dabbling its toes in the F. Jr. pool and if results of its testing are satisfactory may make a big splash. The firm has at least one running now – painted bright red. It uses the 70 bhp Saab engine and, of course, front-wheel drive. The power unit is tilted over on its side for a lower frontal area and center of gravity. It's possible the company may offer the F. Jr. in addition to its line of sedans and station wagons, but we don't think so.

The A.C. Greyhound, a two-door four-seat sedan introduced at the 1956 British motor show, should be available in the U.S. by the time you read this. Its price is about $6000.

Continental Europe is not alone in feeling the effects of the exploding auto population. Recent figures show Great Britain has some 44 vehicles per mile – this includes some areas where hardly a handful of cars are seen in a day. If all of them were on the roads at one time, there would be one every 120 feet throughout the tight little island.

Though Bossaert's Pressé is one of a kind, Citroën itself has a convertible available. Another convertible from France is the Peugeot 403 Cabriolet.

A new and smaller Hillman, designed to compete with the BMC 850 and Triumph Herald, should be on the U.S. scene in about two years. Prototype testing is now underway. It's expected the car will not be as small as the 850 and will be priced between the Renault 4CV and the VW.



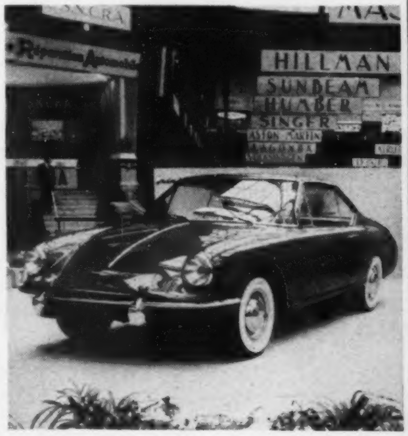
KHARKOV SUPER-KART

While the "English-Speaking Union" was holding its five-tined attack on the Land Speed Record at Bonneville, the Russians were up to some of their own tricks on the dry lakes at Astraken Oblast near the Caspian Sea. Eduard Lorent of Kharkov eclipsed the late Goldie Gardner's Class J (up to 350 cc or 21.36 cubic inches) mark with a five-kilometer run at 136.7 mph, an improvement of 19.2 mph. This makes two International records in Lorent's pocket, as in 1958 he set a flying kilometer mark of 137.8 mph on the Moscow-Minsk highway. The driver seems to be a lot bigger than the car, and his head projects well into the airstream. The black patch on the front fender presumably assists in cutting off light to the timer's photoelectric cell. We are not informed whether this was a two-way average but presume so since the Russians are claiming it to be International as well as All-Union. At any rate, the flag in the background indicates a stiff breeze which didn't make driving easier.

Recipe for uniquess: chop an ID-19 chassis by 20 inches, install an engine with 20 to 25 more bhp, get Italian bodybuilder Frua to design new wraps and, **voila**, the result is the sleek Bossaert Presse.

Bonnier's last minute dash to first place in the Formula 2 Grand Prix of Modena, the finale to the '60 F. 2 season, underscored Porsche's faith in drum brakes in preference to discs. While the firm has been doing some experimenting with the highly-touted discs, it maintains the drum units used on Porsches are not only equal to modern discs, but slightly better. Such drivers as Stirling Moss have concurred in that opinion.

Pointing to the Modena battle in which Bonnier was first under the flag after a duel with Trips in the rear-engined Ferrari, Porsche claims part of the credit for the victory is attributable to Trips' falling behind because of deteriorating disc pads.



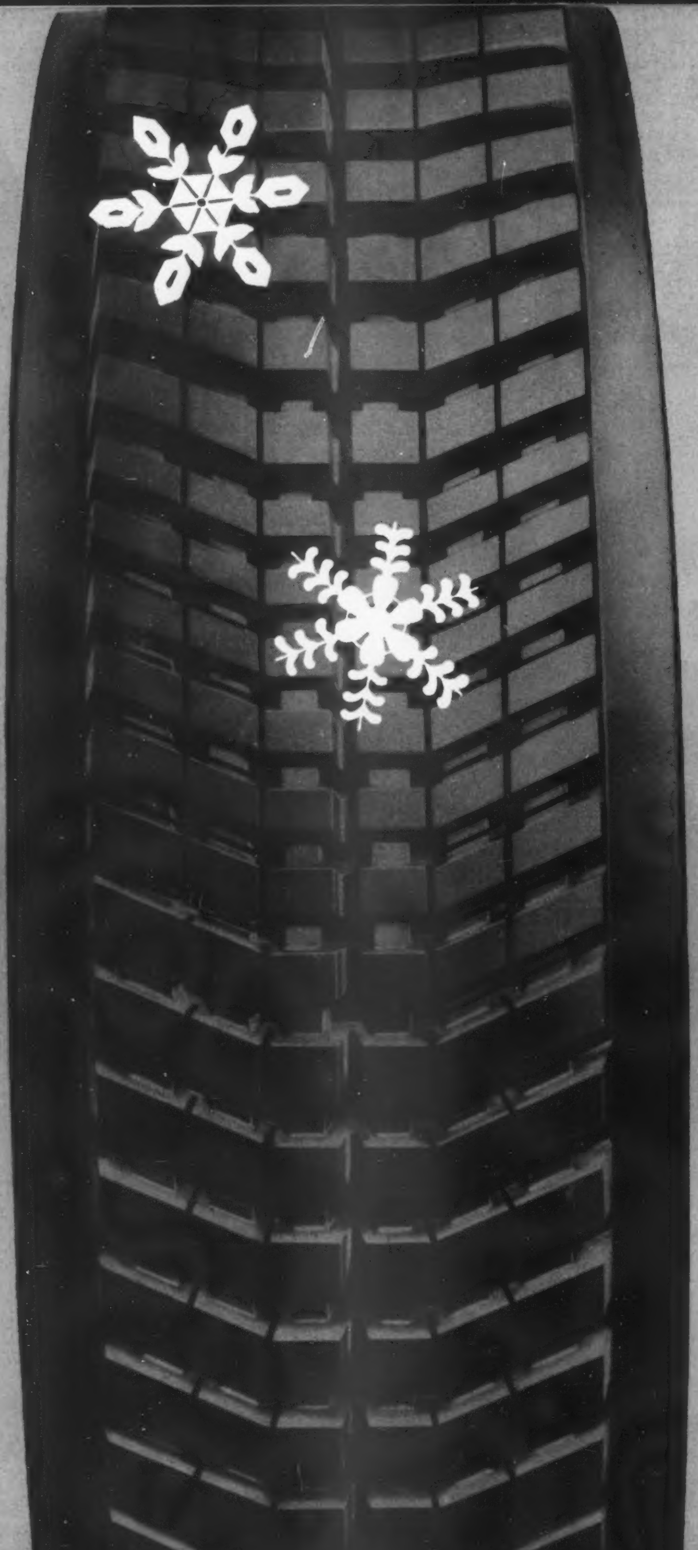
Built on a shortened (100 inches) wheelbase, this two-seater Corvair coupe with its sharply sloping hood line was an attraction at the Pininfarina stand at the Paris automobile show.

ROVER RUMINATIONS

In racing there are now several suspension designs which use the drive shaft as a stressed member. This is a silent tribute to Spencer King, currently project engineer for the Rover T 3 gas turbine, who in the late 1940s defied drive shaft manufacturers by incorporating this feature in the Rover-based two-liter single-seater he built with George Mackie. King is as fruitful in original ideas as Issigonis, which makes us regret that more is not being released concerning the performance of the Rover T 3 turbine, whose handling characteristics are as remarkable as its fuel consumption, performance and power.

Rover, spurred by the Local Employment Bill, has bought a factory site in South Wales to build Land Rovers there. The Land Rover move will give considerable increased space for stepped-up passenger car construction. It's possible this will include building a successor to the P4 sedans, one which would be intended to have a more popular appeal, in view of the increased production capacity. One guess is that it would be a 1500 to 2000 cc model with combined engine-transmission unit on an all-independently-suspended chassis.

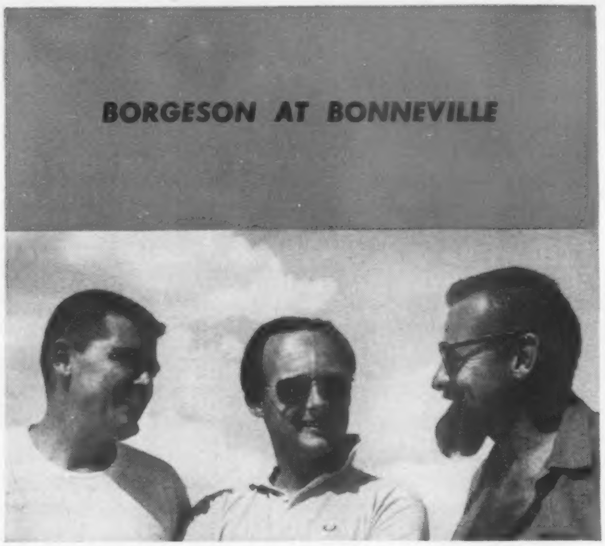
A further Rover development is the firm's intention to send engineers to Africa to study problems associated with operating its cars under bad conditions. Another, looming on the not-too-distant horizon, is the possibility of a two-door hardtop version of the 3-liter, with a more powerful engine and lowered suspension. —*SCI*



The actual speed runs of this year's LSR contenders have had their witnesses . . . as many as a few hundred spectators from nearby communities, plus random passing tourists who drive onto the salt and ask, "Is there any racing today?" They are required to park far back from the course and the most they see is a small speck that moves with the same apparent speed of a distant, fast aircraft. This is not the story. The story's substance is men.

It always seems to begin in childhood with an early compulsion to excel supremely. Then eventually comes the conception by which this success may be achieved. Then comes the realization of the machine with all the economic, technological and human obstacles that this implies. Then comes the driving and development stage. Here fear, if not already present, must set in. Here, too, the economic demands start expanding.

To the economic and personal - internal pressures under which one must live are added those that accompany one's new status as a public figure. Stand on your head for the press and grin winningly all the while; there's no success without a sympathetically vocal press. These are only some of the problems. The story takes place in garages, pit areas, swimming in sweat in hot leathers while cameras grind, conferring with always eager, sometimes doubtful, sometimes accusing sponsors, in compulsive relaxation, in spontaneous unburdenings of soul with somebody who can understand and who has no hooks in your flesh, in the tossing, sleepless nights in motel beds far from all that spells stability, in coughing up the huge insurance premiums, in looking at your wife, but not looking her in the eye. These things are only parts of the story. We were there, living them, observing them for you.



Men made news on the salt, not cars: Thompson, Campbell and Borgeson.

► The Bonneville salt in the fall of 1960 was the arena for the greatest attack on ultimate speed in the long history of the automobile. It is a rare year when *one* bold soul makes an attempt on the Land Speed Record. On a few occasions *two* men have striven for the same goal at the same time. The year 1928 was a fantastic one for speed because *three* men raced against each other in quest of the LSR. In 1960 there were *five:*

Athol Graham — Single-stage supercharged Allison V12, no suspension, two-wheel propulsion; about 3000 bhp, 3800 pounds.

Nathan Ostich, M.D. — General Electric J47-19 turbojet, torsion bar suspension of all wheels, jet propulsion; about 7000 bhp, 6000 pounds.

Art Arfons — Two-stage supercharged Allison V12, hydraulic strut suspension of all wheels, four-wheel propulsion; about 3800 bhp, 4000 pounds.

Donald Campbell — Bristol-Siddeley Proteus turboprop, independent suspension of all wheels by hydraulic struts, four-wheel propulsion with significant assist from exhaust thrust; about 4250 bhp, 8500 pounds.

Mickey Thompson — Four Pontiac V8 engines supercharged by GMC 6-71 blowers, no suspension, four-wheel propulsion; about 3000 bhp, 7000 pounds.

As the world knows, Athol Graham crashed and died on August 1. On his first run of the season he stood hard on the throttle. Spinning rubber, he accelerated to better than 300 mph in about three miles, steadily veered farther off the course until he suddenly got sideways and overturned.

An editorial in the Salt Lake City Deseret News for August 3 stated:

"It seems fairly clear that Mr. Graham in his inexperience and anxiety to succeed took risks that should not have been taken. He paid the fullest price for those risks.

"Athol Graham was a courageous, gifted, thoroughly admirable man, whose death was a genuine tragedy. We mourn his passing and hope other such deaths can be avoided — without, however, ending the probing of the unknown and the challenging of the difficult."

The Salt Lake Tribune formed the Athol Graham Fund for the assistance of his family and contributions came in from such unexpected sources as the inmates of the Utah State Prison. Utah's hot rodders who faithfully attend the Bonneville National Speed Trials stayed away this year; the money they would have spent they donated to the fund.

Dr. Ostich had reserved the salt for August 5 through 13 and began his attempt on schedule. Those of us who had followed this project from its inception could see few obstacles to Ostich's achievement of unprecedented speeds. The adverse possibilities given most serious consideration were (1) front-end lift due to positive angle of attack of the engine's thrust, (2) striking a bump and becoming momentarily airborne, with consequent acceleration in the air as rolling resistance is eliminated and (3) ineffectiveness of front-wheel steering under strong thrust. When questioned on these possibilities Doc would laugh dryly and say, "I'm taking harp lessons, just in case."

Ostich was plagued by a continuum of troubles, most of them minor but time-consuming, others basic. These, including a starter motor failure, kept him grounded until August 10, when he clocked 228 mph on a loafing test run. On the 12th, with his big, cylindrical machine anchored to a pair of heavy trucks, he ran the engine up to 90 percent of takeoff rpm prior to making serious high-speed runs. Due to vacuum and/or sonic shock waves the fiberglass intake ducts collapsed. Through herculean efforts the huge ducts were transported to Hill Air Force Base at Ogden, rebuilt and reinforced. Fantastically, the car was ready to go again the following morning.

Ostich's tires and wheels had been designed and tested by Firestone to perform safely to at least 600 mph. They ran 200 psi inflation pressure and, if flicked by a finger, sounded like a snare drum with its head stretched to the breaking point. While his car was being towed to the starting line at about 40 mph one of its tires rolled over the head of a surveyor's spike that happened to be lying on the course. The damage — a small cut through about three plies — was noted instantly by Firestone's Bill Yarnall, the wheel and tire were replaced and the course was walked and driven until the crop of spikes pulled up in the recent course-dragging operation had been harvested.

The red, needle-nosed Flying Caduceus was fired up and again its eerie, hair-raising wail inundated the desert vastness. Ostich accelerated away smartly, got up to 80 percent throttle and well over 200 mph when the ducts collapsed again before he ever reached the timing traps. He clearly had big problems and returned to Los Angeles to sort them out.

The week of September 4 through 11 had been reserved first by Renault, then by Ecurie Cooper-Climax. Neither showed and this became an open week for those who required the time.

Ostich was back with brand-new, completely redesigned ducts. On the 5th Ostich made a fast pass down the course to try his new setup, began to get increasingly sideways at about 250 mph. On the verge of losing control completely Doc popped his 'chute which straightened his car out almost instantly. He blamed his trouble on crosswinds and made another run. He came droning down the course at about 330 mph when, again, out came the 'chute before he reached the first timing light. USAC caught him in the traps at 267 mph with his 'chute open.

The trouble proved to be a front brake disc that was substantially thicker than the discs on other wheels Ostich had been using. It was causing the lining pads to drag, heat up, lock up and pull the car to one side. This had been rectified by the morning of the 6th. It seemed that at last the de-bugging of the world's first jet car was complete and Doc's expectations were high. The time had come.

It was an absolutely memorable experience. For the first time, Ostich and Thompson were at the same end of the course at the same time. The cool morning air was totally silent until Fritz Voigt began warming up Challenger I's engines; they barked and growled mightily and nitro fumes drifted over the salt. Then, three-quarters of a mile away, Ray Brock triggered the whining inertia starter that soon brought the Caduceus to shrieking life. There in lunar solitude, on the floor of a fossil sea, these hulking, dinosaur-

(*Continued on page 75*)

"I never knew what loneliness was until I started this record business," said Donald Campbell in SCI. There are no bleachers, no stands of spectators on the implacable salt. Its shimmering vastness dwarfs the most imposing entourage; this is the Athol Graham crew.

FLANNERY

SMOG.

It could stand for Society-Manufactured Odorous Goop. It's caused by people (or the things they manufacture), the worst of it smells to high heaven and what else but "goop" would you call something that's a combination of olefinic hydrocarbons and nitrogen oxides? Goop or not, it is fast becoming a serious problem.

by Walt Woron

It's clear in the hills but miserable in downtown Los Angeles when the smog sits at 200 feet. Automobile exhaust fumes are a prime source of smog.

► The most important aspect of smog to owners and drivers of cars, naturally, is how the various controls being inaugurated in California will affect us, and whether this will spread to other parts of the country. Will we have to stand the extra tab of catalytic afterburners just because they have smog in Los Angeles? Will they make us put controls on our cars when we visit smog-ridden areas? Will they make us scrap our two-strokes and diesels? Is it becoming a national problem?

To answer the last question first, air pollution is not only a national problem, but according to Dr. Lester Machta, research scientist for the U.S. Weather Bureau, "If industrial pollution continues at indicated rates, contamination may become global . . . We live in the atmosphere and it is important that we keep it as clean as possible . . . The atmosphere has its limits . . ."

Before we start discussing the controls for smog and air pollution, let's take a look at smog to see what it is. There are two types: the kind common to London is pollution from burning coal combined with low temperatures and fog. This type is also noticeable in cities like Pittsburgh and Donora, Pennsylvania, where there was such a heavy siege of contaminants in 1948 that thousands of residents came down with respiratory and digestive ailments, about 20 deaths being attributed directly to the attack.

The second type of smog has been identified for about 20 years with Los Angeles, where atmospheric and topographic conditions won't allow the problem to "go away". There, a huge basin is ringed by a semi-circle of mountains on one side and the ocean on the other. As contaminants are thrown into the air they rise with the heat. As they do so, cooler offshore breezes move in, but at the same time hot air from the desert spills over from the other side of the mountains, causing an "inversion layer" that's warmer than the air at ground level. This acts just like a roof over a house with no windows: anything that's manufactured inside this "house" is kept there.

Unlike the London-type or industrial smog, Los Angeles-type smog is created on warm days because it's a reaction of sunlight on automotive exhaust gas. The irritants that result are olefinic hydrocarbons and nitrogen dioxide. The olefinics are formed in the engine, while nitrogen oxides are formed whenever *anything* is burned.

"All of which brings us back to the basic truth," says the Los Angeles Air Pollution Foundation, "that since it is impossible to get rid of pollutants once they have entered the atmosphere, we must control them at their sources of emission . . . Los Angeles-type smog is 'photo-chemical,' and the blame for it rests squarely with motor vehicle emissions . . . If all motor vehicles were to stop running tomorrow, there would be no more smog of this type . . ."

Obviously automobiles are not going to stop running tomorrow, nor are giant fans or monstrous tunnels in the mountains going to be set up to create artificial winds that will blow the pollutants away. Other cities have experienced smog attacks where there has been a temporary combination of low inversion and no wind with bright sunshine. But those cities that have sufficient wind to keep the air moving, particularly in the summer when smog is at its worst, may never know what smog is – at least until the number of cars and trucks on city streets exceeds the cubic feet of available air!

Back to the original question: what's being done about smog?

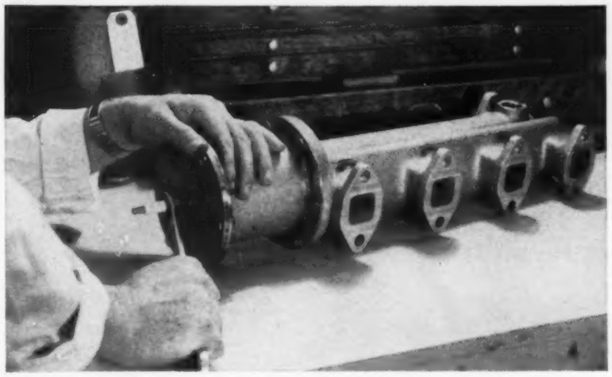
First of all, a number of organizations and bureaus have been set up specifically to combat and control smog. While the initial surge came from Los Angeles, as it should have, the Federal government thinks enough of smog as a potential and actual danger to have passed an air pollution study law that annually absorbs $5 million in taxes from all of us.

In 1953 the Air Pollution Foundation was formed in Los Angeles as a non-profit research organization "dedicated to the solution of the smog problem." Concurrently, the Air Pollution Control District was set up by the Los Angeles County government. Its purpose is to test anti-smog devices, to conduct smog-chamber experiments to find the relationship of gasoline composition to auto exhaust, and to monitor the Los Angeles County air for selected pollutants. The California State Department of Health has been assigned the task of developing standards for quality of the outdoor air in the state and to set standards for motor vehicle exhaust emissions. Their initial standards, announced in December, 1959, are such as to require an 80 percent reduction in hydrocarbon emission and a 60 percent reduction in carbon monoxide – per individual automobile.

At the Federal level, the U.S. Public Health Service is conducting and supporting research on general air pollution problems. Two Cincinnati groups it operates are the Taft Sanitary Engineering Center, which among other things is studying the reaction of auto exhaust in sunlight, and the Occupational Health Field Headquarters, which is looking into the toxic effects of air pollutants. Also involved in air pollution tests and research are the National Institute of Health, the U.S. Bureau of Mines (a pioneer in the field), the Department of Agriculture, the Bureau of Standards and the Weather Bureau.

Private research organizations are conducting broad programs to combat smog. The Stanford Research Institute is carrying out an intensive study of air pollution from auto exhaust. William E. Scott & Associates of Pennsylvania is currently studying catalysts for nitric oxide elimination. Then there's the Franklin Institute Laboratory of Philadelphia, the Armour Research Foundation, the Midwest Research Institute and the Southwest Research Institute.

With this much going on, you'd think that by now we'd have agreement on what causes smog, agreement in principle on how to combat it, and that exhaust emission controls would have become standard equipment on today's cars. Unfortunately, the problem is much more complex than anyone thought—even as recently as six months ago. Part of the problem centers around the inclusion of carbon monoxide in the ambient air standard set forth by the California Department of Health. At no time previously had carbon monoxide been considered as part of the smog reaction, but merely as a general air contaminant.



Chrysler and Thompson Ramo Wooldridge have developed manifold-mounted afterburner that consumes 90 percent of undesirable exhaust products.

Until that time, too, there had been general agreement on the fact that olefinic hydrocarbons and nitrogen oxides were the major constituents that take part in the "photochemical" (sunlight) reaction that makes smog. There was also fairly general agreement that there is a positive relationship between automobile exhaust and Los Angeles-type smog. When the auto industry entered the fray in 1953, it did so on the assumption that cars and trucks were major contributors to the formation of Los Angeles smog. Staying out of the controversies, the industry prefers to concentrate on two points: there is no instrumentation accurate enough to analyze precisely the output from a single exhaust source; when automotive emission controls are placed on cars in the Los Angeles area, the situation will be changed drastically. In this light, the industry as a whole is now carrying on a large research program to develop adequate methods of evaluating exhaust emissions and is cooperating in governmental research programs. Individually, the various companies are conducting private research to find low-cost, adequate emission controls.

Ford's catalytic converter takes place of present muffler, still costs too much: more than $150.

What will eliminate smog? To quote the Air Pollution Foundation again, "From a practical standpoint, elimination of atmospheric olefins will probably eliminate smog, inasmuch as 95 percent of the olefins in the air come from the tailpipes of motor vehicles . . . Another mode of attack would be to remove oxides of nitrogen from exhaust, since without these ingredients the olefins are innocuous . . ." Reduced to its simplest, this means that the hydrocarbons that pour out of the exhaust pipe must be reburned to keep smog-causing particles from entering the atmosphere. One way to accomplish this is to add an "afterburner" to the exhaust system.

There are two types of afterburners, one which uses a catalyst (a substance which causes a chemical reaction to take place but remains essentially unchanged itself) and one which ignites the unburned hydrocarbons remaining in the exhaust. At the present time two catalytic afterburners and one direct-flame afterburner have been publicly announced. None, however, is ready for the market.

The direct-flame afterburner being developed jointly by Thompson Ramo Wooldridge and the Chrysler Corporation is somewhat larger than a muffler and operates on the principle of adding air to the exhaust by means of an auxiliary pump, heating the mixture in a heat exchanger, then firing it with a spark plug. After combustion the clean and cooler exhaust is then discharged. According to Chrysler, it acts as an efficient silencer and can therefore replace the muffler. It has been tried in different locations in the exhaust system in place of the muffler, and under the hood at the exhaust manifold. It appears to function better at the manifold, and is capable of removing approximately 90 percent of unburned hydrocarbons and a similar amount of carbon monoxide from the exhaust. The only maintenance required will be by the air fan (its one moving part) and the spark plug; in the under-the-hood location this should be relatively simple. Attempts are now being made to make an even simpler, more durable and compact unit at a reasonable price.

An oxy-catalyst converter developed by Dr. Eugene Houdry for Oxy-Catalyst, Inc., is now undergoing tests by General Motors. In this system the energy to sustain combustion is provided by a pelleted catalyst that induces flameless combustion and is said to reduce about 90 percent of the hydrocarbons. Two recently experimental (*Continued on page 84*)

THE TWO STEAM HORSES OF MONSIEUR BOULANGER

One journal called it "a vehicle with every virtue except speed, silence, and good looks." Richard Bensted-Smith calls it the 2CV Citroën—among other things. / The first time I ever visited the Quai de Javel–a name I tend to associate with Georges Simenon whodunits and hatchet-faced Paris flics pursuing the ungodly in black *traction avant* Citroëns–was in 1954, on the day after Citroën condescended to reveal to the world its hydropneumatic suspension. By the company's standards of public relations at that time it was pretty nice of them; something like the Treasury Department calling a press conference to announce the combination of the lock on the vaults at Fort Knox. It made much the same kind of impact on a France which had been willingly lining up for 20 years to buy black Citroën sedans (no other color was offered). Being a day behind the rush, I was taken out on a demonstration run, in the course of which I asked the chauffeur to stop while I crawled in the dust with my Kodak and tried to take pictures of the bits underneath. Eventually I gave up and suggested that we go back to the factory, where they could stick the car on a hoist for me to take pictures in comfort. The chauffeur then looked me straight between the eyes and explained without blinking that there was, regrettably, no hoist in the Citroën factory.

There may be a moral in this somewhere. If nothing else, it probably explains why I associate the Quai de Javel with mystery stories, and how about once every ten years even the most insidious spies of the French press find a news story breaking over their heads without so much as a four-minute warning. When Citroën want you to know, they'll tell you; until then you won't know.

The late Pierre Boulanger's two steam horses hit France in much the same way. In 1936 the then head of Citroën ordered a market survey; in 1938 three hundred (*Continued on page 80*)

Road Test: FERRARI 2+2

► At the time of this trial there were three Ferrari 2+2s running around Modena. Number one was the original prototype, number two the production prototype and number three the first actual production car. The latter was being used by Commendatore Ferrari himself, and needless to say we did not get our hands on it, but we were able to sample numbers one and two extensively.

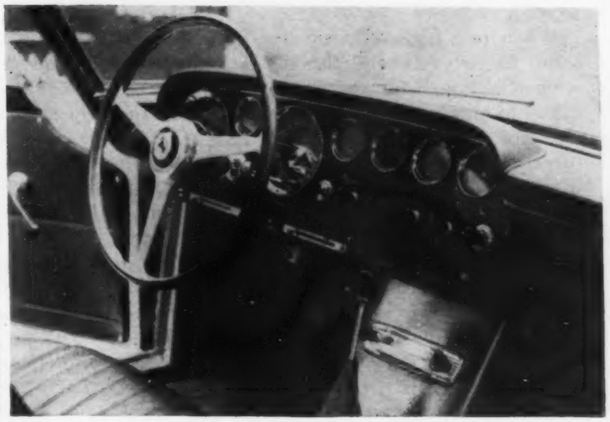
The 2+2 is the first four-place production Ferrari in history. A thousand are to be built, the bodies naturally being fabricated in Pininfarina's Turin factory while the completed automobiles emerge from Ferrari's Maranello plant. The first run should extend over several years as the rate is not much more than one a day. A hand-built automobile in the truest sense of the word, it replaces the lovely 250/GT Farina coupe.

Farina's new body for the 2+2 may not be as lovely to look at as the two-seater coupe it supplants, but it is certainly roomier. There actually is room for four adults despite the fact that the two rear seats are titled "occasional". If you're over six feet tall, you will find yourself slightly bent sitting in the back, but for average folks the rear-seat head- and knee-room is quite adequate for comfortable travel.

How is this extra room achieved? The 2+2 has a 1.6-inch wider rear track and is one foot longer overall but an inch narrower and 2½ inches lower. The improved streamlining has increased the car's maximum speed by five to ten miles per hour. The classic 3-liter, 240-bhp V12 engine is moved forward in the chassis 6½ inches to provide the necessary extra legroom. It also brings the center of gravity part way with it. Compared to the two-seater model, the weight distribution shifts from 49/51 to 55/45 with negligible fuel loads. With a full – 26½-gallon – tank, it improves again to 53/47. Overall weight is up some 400 pounds. The few engine changes made are principally concerned with further smoothing out the V12 and improving its torque curve, to the point where you can only describe the powerplant as one of the most flexible touring engines of the day. Constant experimentation on the exhaust system has resulted in quieter operation without any loss of power. A subtle detail improvement on the new car is the use of nylon bearings in the cable-operated accelerator pedal linkage.

The Laycock overdrive which operates on 4th gear only is standard equipment, with the 4.56 back axle ratio only. The 2+2 is the first production Ferrari to be fitted with Koni telescopic shock absorbers.

The performance of the Dunlop disc brakes is almost as impressive as that of the engine. This Ferrari, with three people on board and a full tank of fuel (gross weight of



COLTRIN

Instruments and controls will delight the most discriminating driver. Next to the clutch is a place to put your left foot to brace yourself.

For under-six-footers, the richly-upholstered back seats offer barely adequate space but have pleasant amenities such as armrests and ashtray.

over 3800 pounds) will accelerate from rest to 100 mph and come back to rest again in 25 seconds. This trick was initiated by Aston Martin with its DB-4 and has perhaps received more attention than it deserves. Sent out with us from the factory to do the acceleration runs was Phil Hill, and it was his opinion that with practice a driver could steadily improve on this total time. A word about our acceleration times: out of necessity these were taken with a full tank of fuel and with three people aboard. In other words, we weren't being overly fair to the automobile, but the times achieved are not

Production prototype, car #2 features pair of Marchal fog lights in grille. Soft, touring suspension lets it roll sharply when "on the limit."

at all bad. With 500 pounds less weight they would undoubtedly have been improved and a 0-60 time of 7½ seconds seems a certainty.

When one is used to smaller European cars, the Ferrari seems big from behind the wheel. Visibility front and rear is good although for short people the driver's seat could be raised to eliminate looking through the steering wheel. Glass area is expansive, particularly the rear window. Taking many turns, the windows in the doors roll up easily. Ventilation wind-wings are opened by a knurled knob à la Mercedes 220 (1960 vintage) but only partially. Porsche-like hinged quarter windows ventilate the rear passenger area. The glove compartment is tiny, but considering the large additional stowage areas throughout the automobile this is a minor criticism. Fresh air is brought in directly beneath the windshield. A slightly different instrument layout has the oil pressure gauge located between and above the rev counter and speedo, directly in front of the driver's nose. The other gauges (oil temperature, water temperature, fuel, and clock) are ranged in a row across the center of the dash. A row of unmarked black knobs are strung out along the underside of the dashboard. Below them are the heater controls. The parking brake is in an especially good position alongside the driver's right leg and is extremely handy to operate. Seat adjustment is outstanding, with reclining backs on both seats. The standard of finish is high and the natural leather seats contribute to the superbly luxurious atmosphere of the Ferrari's interior.

The most lasting road impression is that this Ferrari is safe, stable, and very easy to drive. It's a car that one grows to like. Lazy drivers can forget the gearbox (the 2+2 will pull away from 1000 rpm in fourth gear with ease – that's only 18 mph). It's difficult to realize that such fabulous performance comes from only three liters. The responsiveness of the V12 is thrilling. You notice this the moment the husky-sounding starter motor is engaged for the engine leaps into activity instantaneously. Just as sensational is the effect of putting your foot down hard in second gear at 5000 rpm and feeling the insane way the car moves out.

The crisp, firm gear change is hard to improve upon except for its tendency to snag reverse on quick changes across from second to third. Maximum usable revs are 7200 and with the standard 4.56 gears this gives a top speed of 105 mph in third and 129 in fourth. Tops in overdrive is 136 mph (6000 rpm). Noise at this speed is marked, particularly from the wind, but high-speed cruising is the 2+2's forte. At speeds over 100 mph the overdrive is most useful. It can be flicked in and out by the handy lever on the steering column.

Summarizing this Ferrari is not difficult. Pininfarina and Enzo Ferrari have collaborated to make a most desirable motor car: expensive (price is the same as the former coupe – $12,600) fast, and luxuriously comfortable, with a large luggage compartment. All this adds up to a *Gran Turismo,* with the accent on the *"Gran"*, par excellence. If you want to go road-racing look to the Berlinetta, but for touring in the grand style, "Two plus Two" equals near-perfection.

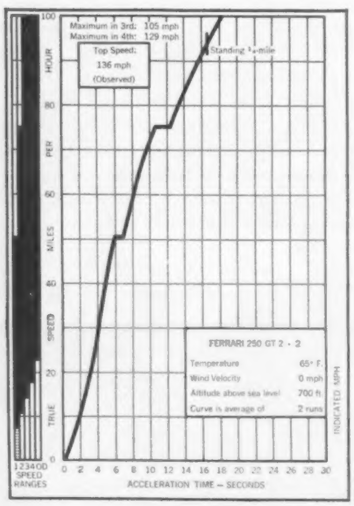
–Jesse Alexander

ROAD TEST

FERRARI 250/GT 2+2 COUPE

Price as tested: $12,600

Importer: Luigi Chinetti Motors
780 Eleventh Ave.
New York, N. Y.



ENGINE:

Displacement	180 cu in, 2953 cc
Dimensions	Twelve cyl, 2.87 x 2.32 in
Compression Ratio	8.8 to one
Power (SAE)	240 bhp @ 7000 rpm
Torque	180 lb-ft @ 5500 rpm
Usable rpm Range	1000-7200 rpm
Piston Speed ÷ $\sqrt{s/b}$ @ rated power	3010 ft/min
Fuel Recommended	Premium
Mileage	14-16 mpg
Range	370-420 miles

CHASSIS:

Wheelbase	102.4 in
Tread, F, R	53.3, 54.7 in
Length	185 in
Suspension: F, ind., wishbones, coil, anti-roll bar; R, rigid axle, leaf springs, radius arms.	
Turns to Full Lock	1.5
Tire Size	6.50 x 15
Swept Braking Area	490 sq in
Curb Weight (full tank)	3280 lbs
Percentage on Driving Wheels	47%
Test Weight	3810 lbs

DRIVE TRAIN:

Gear	Synchro?	Ratio	Step	Overall	Mph per 1000 rpm
Rev	No	2.96		13.53	6.0
1st	Yes	2.54	—	11.61	7.0
2nd	Yes	1.70	49%	7.78	10.4
3rd	Yes	1.26	35%	5.77	14.1
4th	Yes	1.00	26%	4.56	17.7
4th OD Switch		0.78	28%	3.56	22.7

Final Drive Ratios: 4.56 to one with OD std., 4.25 and 4.00 available without OD.


MUELLER

PHIL HILL RELIVES HIS FINEST YEAR

As top driver for the world's finest racing team, and as the first American to win a modern G.P., Phil Hill made 1960 his greatest year. To review that year for you, Jesse Alexander recreated it with Phil in Modena. The results make for exciting reading.

Phil, let's begin with Buenos Aires and follow right through the season.

Okay, first we'll start with the sports car race. During practice it appeared that, at the beginning, it was going to be a battle between the Ferraris and Maseratis, and the race boiled down to just that. I was driving with Cliff Allison, and Gurney was with Gregory in the Maser. Dan drove very hard and quite fast during the first spell out there, then Cliff promptly passed Gregory when he took over. Gregory wasn't on the best of form, understandably; it was his first race after his incident last year at Goodwood. His arm was still giving him trouble and the car was quite strange to him. Also, they began to have some trouble with the car at that point. At any rate, Cliff and I won the race, though it certainly wasn't as difficult as it might have been had the Maserati continued running well.

And you almost had a similar success in the Grand Prix race a week later.

Yes, my car had the single-cam six-cylinder engine, while the other drivers had the normal double-cam six. Strangely enough on that little circuit my car appeared to be just as good; certainly I had a very usable kind of power. The cars were very strange-looking, being last year's cars modified. The tanks were moved up from the rear to the sides and they had great whale bellies, somewhat similar to the Squalos of a few years back. To maintain the same weight distribution, the engine of course had to come *way* back. I'd say there was a space of a foot or so between the engine and the front framework. The handling wasn't *too* bad, actually. Of course on a slow circuit like that you can usually make the best of a car that has a few little vices; you can sometimes utilize those very vices to make the car do what you're trying to do.

By luck I almost won the race. I think I was back in fifth or sixth place, and one by one the leaders began to drop out. I started getting water in my face from Brabham's car, which I was challenging at that moment and was getting ready to pass—he wasn't doing anything particularly spectacular that day. Finally I looked down at my temperature gauge and realized that it was probably my car. Sure enough, I pulled into the pits just as the engine was getting ready to seize and found that I had a split in the main pipe from the engine to the radiator, which necessitated changing the water pipe and hose. I was just out of it by the time I got back in the race again, but it looks as if I might have won if that incident hadn't happened. I had about 50 seconds on McLaren then, and he did win.

Next race on your docket was the Targa Florio.

Right. We were there six days ahead of time, with one *muletta* (practice car) — a 1955 Monza. Each year our *muletta* seems to get older. Last year we at least had a twelve-cylinder car of more recent origin, but this year's was probably the most delightful and most interesting *muletta*

we've ever had, except that it had a broken rear spring and a number of other things that made it difficult to drive. It had the *ideal* kind of power that you need for the Targa Florio, just *right there* every minute. I took it around the 48 miles in 48 minutes and 30 seconds, which was sort of surprising to us — being able to get what appeared to be an absolute wreck around the circuit that fast. On the only day the road was closed for practice, Richie Ginther crashed our Monza into a house near the place where I crashed into the Vespa truck two years ago, and just wrote it off. I did a 45-minute lap in our race car and Cliff, after he took the car, had a terrific crash and ruined it – finished it off. At the end of the eight-kilometer straight there's a very fast S, probably in the range of 130 miles per hour. As he was going into the left-hand part the left front tire went flat, so when he started to turn back to the right, the car just went straight, naturally, on a flat front tire, and right off the road he went.

Very much of the Targa is driven as if you were on a fast tour, knowing that no one was coming the other way. You drive it visually, as you see it coming. Of course as you go over it and over it and over it, what you learn about what you see changes your manner of driving it. I'd say it takes two weeks to learn the circuit properly.

Mike Hawthorn didn't like the Targa. Do you know why?

He *hated* it. He just didn't like it. He thought it was too dangerous, and I think he decided before he tried it that it was impossible to learn, so why bother? I know I took him around the circuit many, many times with him asleep in the back seat!

Another thing about the Targa circuit is that you can't depend on it, like you can most other racing circuits. Every time around you always have to leave a little tiny margin, in case someone has gone over the inside of the road and swept gravel over it. And the road is in a very bad state up there. Remember that up in those hills there's snow in the wintertime that tears the road up pretty badly, and they wait until the very week of the race to do the repairs. Consequently all your practice is done with the road full of steam rollers, and men with little brooms and tar and stuff, pushing it around. It's very difficult the day of the race to undo all this conditioning.

At any rate on the first lap Trips left the road in our single-cam 2.4, complaining of locking front brakes. They did have a *tendency* to do that during the race. He bent the car; the front suspension was all goofy and the car never did feel very comfortable during the race. We finished in second place, behind the Porsche. Our car had independent suspension at the back, which showed a lot of promise, especially in the way it went over bumps and accelerated out of bumpy turns, but it still hadn't been worked out completely. Bends that had a rise or fall in them, like a hump-backed bridge, were particularly difficult.

Then you went to the Nürburgring for the Thousand Kilometers, which of course was a duel between the Camoradi Maserati and the Ferrari team – and the Porsches.

All the practice took place in the rain. We were very much aware that the grip our tires would get on the wet road was going to be a real factor, so of course we tried different kinds of Dunlop tires, which didn't seem to make much difference. We changed the axle ratio on my car, because Dunlop said that we couldn't use the 15-inch tires because the wear factor was so bad, so we changed to 16s. We also changed the roll bar so that the car would "point" a little better. At the Nürburgring you definitely need to be able to get the tail out a little bit; it's that kind of circuit.

We were leading the race at one time, but that car broke while Trips was driving it; I think the engine finally went. This was one of the first sports car races in which we had rain and actually had to look through that darn regulation windshield, and it was terrible – rain coming on the *inside* of the windshield — it was very, very difficult. The Maserati people were much better equipped to see over the windshield than we, to cheat a little bit. I say "cheat"; actually there doesn't appear to be anything in the regulations that says that the driver can't accommodate himself to the car, whether this means that he has a foot of cushions under his tail as he gets in, or whatever.

Your next championship G.P. race was Monaco. You once called Monaco a "freak circuit" . . .

Well, it *is* a freak circuit. If someone said to you, "I've got a wonderful brand-new circuit. It's 1.9 miles long, and it has six hairpins and the longest straight is 150 yards", what would you say about it? The fact is that it's in Monte Carlo, and if it were anywhere else I don't think anybody would even consider it. It's not feasible as a race circuit.

We thought it was going to be a horrible weekend, and actually it wasn't as bad as we thought. Our cars were anything but suitable there, being front-engined and heavy and all that, but we weren't back too far on the starting grid, and during the race things worked out surprisingly well. I finally finished third. If I hadn't been so exhausted at the end I might have been able to finish second; I can't say for sure. A hundred laps there is a long, long time, and with our cars it took a lot of energy to herd them around, believe me. We had to use rather freak (*Continued overleaf*)

Phil found the cobblestones at Oporto "so bumpy that it made your eyes blur." He wore short-sleeved shirt in practice, full fireproofed coveralls in the race. In Portugal Dan Gurney (number 15) showed all of his old fire in a new B.R.M. that gave him confidence. Below, Phil's at Monaco, which he calls "a freak circuit. The fact is that it's in Monte Carlo, and if it were anywhere else I don't think anybody would even consider it." Lighting up a cigarette is Innes Ireland, whose matinee-idol features were much in evidence as top driver for Lotus last year. From the right peers the profile of Jim Clark, another new 1960 star.

WEITMANN

methods to get them around the course at all. Heat in the cockpit wasn't bad this year; they sealed everything off really well. I made sure of that before the race. Last year, of course, it was terrible.

Just eight days later you were up at Zandvoort for another G.P. How do you like the Dutch circuit?

I've never liked it for some peculiar reason, perhaps because we've never had a car that's been pleasant to drive there. There's one interesting thing, though: the Dutch circuit stands out as the one place where a difference in the driver's position in the car really makes an incredible difference in what you can do with the car, and in the driver's comfort. We tried a little experiment there. On the first day of practice we found that this feeling of being on the end of a string – and being *flung* – was even greater than it was last year. But when the rear-engined car came up we tried it in direct comparison to the front-engined car, even to the point of following each other around, nose to tail, at the same speeds. After we compared our reactions it became really clear to us that where the driver sits in the car is of terrific importance. The rear-engined car is so comfortable and easy to drive, and things like a seat that grips you tightly are so much *less* important than they are with a front-engined car that you wouldn't believe it!

The one thing I found that made it even more difficult to drive the front-engined car, this year, is that the driver is almost a foot farther back than he was last year. Remember that when we moved the fuel tanks the engine had to come way back, and to do that the driver naturally had to be moved farther back, which manifests itself in making the car just that much more difficult to drive. You *feel too much* when you're back there. The rear end isn't stable, like the front. It does things in a much more violent fashion. When the driver's subjected to those things, it tends to mask the things that he's *trying* to feel. Every time the tail jumps out the driver goes with it, and for a flash there he's out of contact with what's going on. We found that really to be true at Holland.

We got our front-engined cars going a little better in training, and then by race time we had full fuel tanks and a lot of other things and we just never had time to sort them out. And the cars that were bad in practice became good during the race and the ones that were good in practice became bad during the race! I had an awful lot of trouble with mine; I was terrifically bothered with extreme understeer at first, then I started having trouble with the throttle sticking. It was a slightly different system of throttle rods and it just wasn't any good. I finally had to stop altogether because it just couldn't be repaired.

Next on the calendar was the Belgian Grand Prix at Spa, where you put in a very quick lap on the final day of training.

Well, we were able to get our car working better there. Also, since the course is so fast, it minimizes the embarrassing effects of our excess of power combined with roadholding that wasn't quite what it should be. In other words, you've got the old hoof down practically all the time. We found at Spa that our cars were not superior on top speed this year. Last year at Avus we definitely had an advantage on speed, and this year, even on a limitless straight, we just plain didn't have it. Our roadholding at Spa didn't seem to be much inferior to the others, and there were a few turns where the gentle understeer of the front-engined cars was very desirable. As far as my quick lap went, I can't say anything particular, except that I finally began to learn the circuit (I'd never driven there before, you know) and was able to turn that lap fast enough to get on the front row. This was more or less justified because I was in second place during the entire time before my emergency stop.

Tell us about that, Phil.

Well, I began to notice something very cold hitting me in the face and on my left leg, and suddenly it became an icy blast. It was fuel leaking from the Bourdon tube in the fuel pressure gauge, down into the air stream from the cockpit ventilation pipe and chilling the air, of course. There were not too many laps remaining – maybe eight or ten long laps — and just as I was going by the pits I was contemplating "should I go in or not?" There's nothing worse than being in a good position in a race and stopping for nothing. Well, I hadn't gone a mile further when suddenly I had flames licking around my left leg there, and the cockpit had sort of a low-grade fire going, one of those smoky, orange-colored flames — sort of the *crepes suzette* kind of fire, you know.

I stopped in a panic, leapt out and put the fire out on me; it didn't burn me at all because I had fireproof coveralls on. I had quite a bit of trouble getting the fire in the engine out, though. I had stopped the car going downhill, put my foot on the brake and undid the hood from inside the cockpit. I managed to get in with my hands, smashing and flapping at the fire, you know, then finally I decided I had to get the hood completely off in order to get it properly out. The minute I got out of the car, it started rolling. I had my foot propped into the rear wheel and then it ran over my foot and I had a terrible time. I threw the hood back on as the car was rolling, jumped back in again, went on down 100 yards and parked the car against a small concrete abut- (*Continued on page 88*)

MUELLER

Tough competition came this year from John Surtees, at left, and Stirling Moss, number 28. Phil told us, "It was very rewarding to start down the hill a certain distance behind Moss and Surtees, both driving Lotuses, then come out at the bottom . . . approximately the same distance behind." A team conference takes place below, with Ferrari himself looking on. Wolfgang von Trips and Richie Ginther join Phil at a testing session at Monza. Below is Jack Brabham, Champion for the second year, who was more often harried and harassed by Phil than by any other driver. Hill was kept from collecting his fair share of points this year by failures of the usually-reliable Ferraris, but it still stands as his finest season ever.

WEITMANN

► Robert Eldon Drake, Los Angeles restauranteur, charter-fishing-boat operator, ex-deep-sea diver, liver of the good life, is one of the West Coast's best sports car drivers and such he probably will remain. While the fires of foreign combat exert a powerful draw on most road racers, Drake is content to do what comes naturally and not much more. Europe? It's nice, he's been there, "but it's a hassle and every weekend you've got to learn to count the money all over again." Sebring? He's driven there several times and likes the circuit, "but it's too far out in the middle of nowhere. I had to drive 163 miles to get to a night club." Race every weekend? "That's like skin diving every weekend; you get tired of it. There are other things to do. Last weekend I had a charter for the boat; why pass that up?"

Drake, who admits to 36 years, is one of the few part-time drivers who has mastered the sport both technically and emotionally. Although by the rules he is a professional and he much prefers to get paid for his efforts, he has the outlook of a true amateur: he races because he enjoys it. He has very little of the fierce animal desire to conquer that is crucial to many of the world's great drivers but is the bane of many less generously endowed with the necessary physical skills. Drake's attitude is similar, although on a different level, to that of Tony Brooks, fulltime dental surgeon, part-time Grand Prix driver.

No single calling can be said to claim Drake's full time. After World War II service in the Navy, he operated a deep sea salvage company in his native San Francisco, raced boats and one day found himself racing midgets when "I found the head for my boat I was looking for, but it was attached to a midget." He migrated south and in 1950 had his first sporty car go in an MG TD owned by Mary Davis, a very successful economy-run driver. Their partnership developed into co-ownership, along with Judy Allen, of the Grand Prix restaurant, an L. A. spa fitted out for the sports car crowd. Drake is anything but a hard-driving entrepreneur; friends insist that the restaurant would be even more of a success if Bob spent all his waking hours there. But he finds irresistible the calls of other pursuits, such as skin diving or running his boat out of San Pedro . . . or racing.

When Drake does race he likes to win, to be sure. "But some days I drive better than other days. If you don't feel good there's no point in sticking your neck out." Almost unbelievably, there is no noticeable change in Drake's relaxed

Drake displays his customary good humor as he wheels the Birdcage Maser to another win at Vaca Valley. That's a prancing donkey on his crash hat.

and humorous demeanor before, during or after a race. One person was startled to have Drake excuse himself barely 60 seconds before a race he was to drive in. Drake had been so loose it seemed unlikely he was even driving in that day's events. Drake admits to getting sore occasionally when another driver repeatedly blocks him in turns, Drake's favorite part of a course, but his usual attitude while hurtling down straights and through turns is one of high spirits and good humor. He is wont to "salute" friends on turns with a digit of one hand and photographs taken during crucial races often show him smiling broadly.

Drake is no clown. This Spring, he took Joe Lubin's Birdcage Maserati and put on a fantastic show in a very tough league. Of eight races entered, he won five, failed to finish two and in the eighth was forced back to second in the final laps when the oil fell out of the rear end. The car had changed owners before the eighth event and it changed drivers afterwards. Just for kicks, Drake drove Max Balchowsky's Old Yaller II in a race in which the new owner-new driver Birdcage was entered. Drake was leading the Saturday event by such a healthy margin that the Birdcage was prudently withdrawn from both that and the Sunday feature.

The Lubin-Drake partnership has prospered because of Drake's open and uncomplicated ways and Lubin's commendable habit of letting Drake do the driving – with a minimum of second-guessing. In the team's greatest victory, one which is still talked about on the West Coast, Drake virtually drove the insides out of a new 1.5 Cooper-Climax sports car and got nothing but cheers from the car's owner. It was the winter of 1956 at Palm Springs. Drake started way back in a race expected to feature Jack McAfee, Jean Pierre Kunstle and Richie Ginther in 550 Spyders and Class F national champ Pete Lovely in John Edgar's recently-imported and highly-touted RS. In the early stages of the 35-lapper over the three-mile circuit Lovely ran off and hid. It looked like a dull race.

At the fifth lap "unknown" Drake started picking off the slower 550s, much to the spectators' surprise and the Lovely crew's consternation. Frantic "go" signals were flashed at Lovely when Drake moved into second place but just when it seemed there might be a real race, the Cooper sputtered into the pits. Sixty-five heart-rending seconds were spent repairing a spark plug lead and when Drake rejoined the chase he was in eighth place, 80 seconds behind Lovely.

With a broad grin on his face contrasting with the grimaces and encouraging screams from the spectators, Drake set about getting the job done. With 23 laps to go he had caught up with the Porsche pack and was in fifth place. Four laps later he was only in fourth; four more and he was out of the jam and in second. Fifteen laps to catch a good driver in a car which had finished fifth at Le Mans. Drake did it in nine and eased off to win by four seconds in a car with no oil, no brakes and the transmission locked in third gear. A victory lap was out of the question.

Not all Drake's efforts have been as well-rewarded. There was his stint with Tony Parravano, a fellow who owned a herd of potent cars but left considerable doubt as to whether he belonged in a sport with pretentions to the gentlemanly and genteel. At one time Tony planned to have Drake drive in Europe. Drake expressed his lack of awe for the project by having a prancing donkey painted on his ancient black and yellow leather helmet. "Thassa not Ferrari's prancing horse," said Tony quizzically, "thassa donkey." "I know," said Drake sweetly, "I'm a jackass to drive for you." Tony and his projects are long gone (both racing and tax officials had some questions to ask), but Drake cherishes the floppy helmet with the jackass rampant. He grumbles loudly when required to wear a Snell Foundation hard hat because, he says, instead of listening to the engine all he hears is wind whistling through the helmet.

Tony and Drake never made it to Europe; the farthest they got was Sebring in a 4.5 Ferrari with McAfee as co-driver. Race eve lasted past midnight with Drake trying to talk Tony out of having the required seal on the gas tank filler cap wired to the car's skin. Drake explained over and over again that vibrations would tear loose the filler pipe, spilling gas on the exhaust and starting a fire. He thought he got his point across. Next morning Drake found the seal wired to the skin with a marvelous thoroughness and solidity. "A little something for the boys," said Tony, pointing to the pit crew. McAfee made about half a lap before the car erupted in flames and he bailed out. Peering intently at a stopwatch as the cars roared by the pits, Tony asked, "Whersa McAfee?" Drake pointed at an enormous pillar of black smoke and said, "There's your little something for the boys, Tony, a goddam weenie roast. I'm going water-skiing."

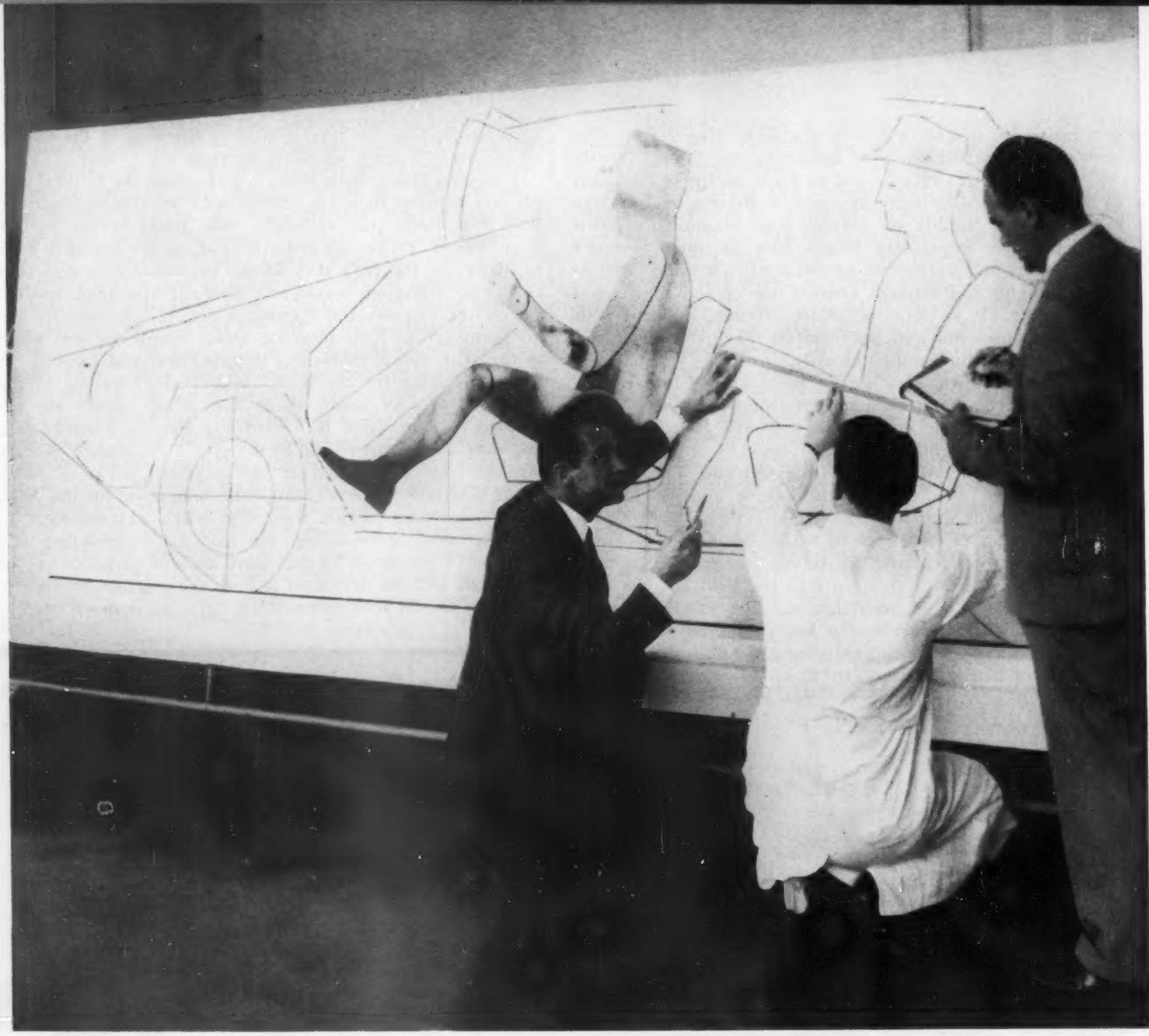
Drake went water-skiing. He may be water-skiing this weekend. Then again he may have decided to go racing, in which case he'll be welcomed to both the pits and the trophy table, a familiar and entertaining figure at both.—*S McN*

Not many males fit the stereotype of the Southern Californian: marvelously suntanned, very healthy, and utterly relaxed. Bob Drake does, in spades.

MOTORIZED BEACHCOMBER

by Steve McNamara

PARKER



In mid-October, the public first saw the new Taunus, but to the people at the factory in Cologne, Germany, the 1961 model was already many months "old." It began, naturally, on the drawing boards. Since cars must be made to serve people, space for humans was a prime consideration in designing the car. Designer Dalberg, left, received three years' training in America in planning the replacement for the gothic-styled 17M and 15M types. The new car will be available in three forms: two-door, four-door and station wagon. Shoulder room's increased 5 inches.

After the drawings, the next step was testing models in a wind tunnel at Stuttgart. Here a craftsman makes trial cuts on a clay model. While the Ford ancestry of the Taunus is evident, the designers were given a virtually free hand. The result is somewhat suggestive of a smoothed-out Falcon as the Taunus styling breaks away from the current European angular trend as represented, for example, by the new Opels. Engineers sought to give the car a shell which would offer better penetration of the air. It is lighter than current models, using a cross-braced underframe and a lightly-stressed top structure. The car's steering is lighter and, reportedly, some may find it difficult to place the car on line in a fast curve. Maximum gasoline mileage is said to be improved: increased from 23½ to 25½ miles per gallon. Acceleration figures are faster too, with 0 to 60 now attainable in 21 seconds, compared to 24 with the present model. The new Taunus thus looks better and goes better as well.

Birth of a Body

Amid a welter of rumors of VW-sized American Fords, possibly to be built in Europe, Ford of Germany introduces a new shape for its well-tried 17M engine and running gear. Is this the new small U.S. Ford? We don't think so — it's too conventional, too close to the Falcon in size — but it may well hint at the outline of the V4, front-drive Cardinal-to-come.

PHOTOGRAPHY: WEITMANN

An ingenious American-designed machine was used in translating the contours of the sculptured three-eighths-scale clay model into a full-sized mock-up as shown in this picture taken in the styling department. The car will use a distinctive flattened oval headlight in European models, but they will not be delivered so-equipped to the U.S. The unusual headlight is said to give an improved low beam with a much wider, flatter pattern than usual with round lamps. Focusing the beam has not presented any problems. The carefully-prepared full-size model was used in making the dies for steel body pressings for the actual automobiles now in production.

The testing program that precedes introduction of any new model was accelerated at Ford-Cologne by the extensive use of special machines. The car on the machine above is being subjected to constant racking, bumping and shaking. Close watch is kept on all the joints and assemblies to determine what ones may not be up to production qualities before the actual construction of the new cars begins. The result is an all-new model with as few "bugs" as possible. Laboratory testing is, naturally, followed up with thousands of miles of road testing by factory technicians.

Some of the factory testing was carried out on the island of Corsica. These early Taunuses show the two headlight configurations; the one in the foreground will not be available here. A few laps at the Nurburgring revealed the car has a fairly soft ride, although rough sections on the circuit were more noticeable in the rear than in the front seat. The engine is the familiar 60-bhp powerplant used in the current Taunus models. Reportedly, there's a 75 bhp unit in the works, but it's expected it will be used first in police cars before reaching the public.

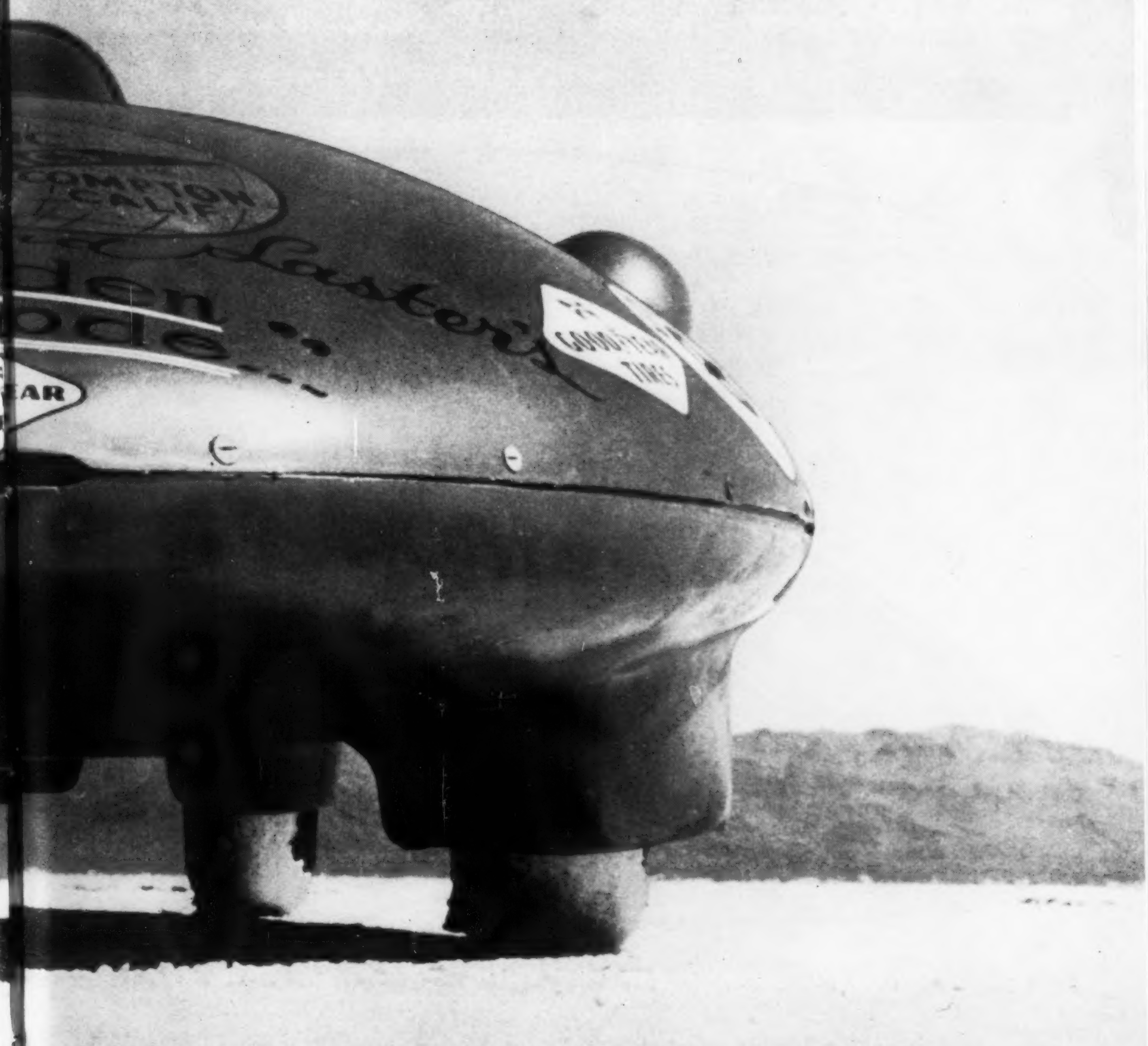
MG's teardrop record-breaker confirmed the beliefs of Bill club with a Falcon-powered streamliner shaped like a pumpkin

SCI'S 200-

by Griff Borgeson

Burke and Bob Laster, who made the exclusive double-century seed. Major land speed records are now within their reach.

mph FALCON



► In these pages for February, 1960 we stated:

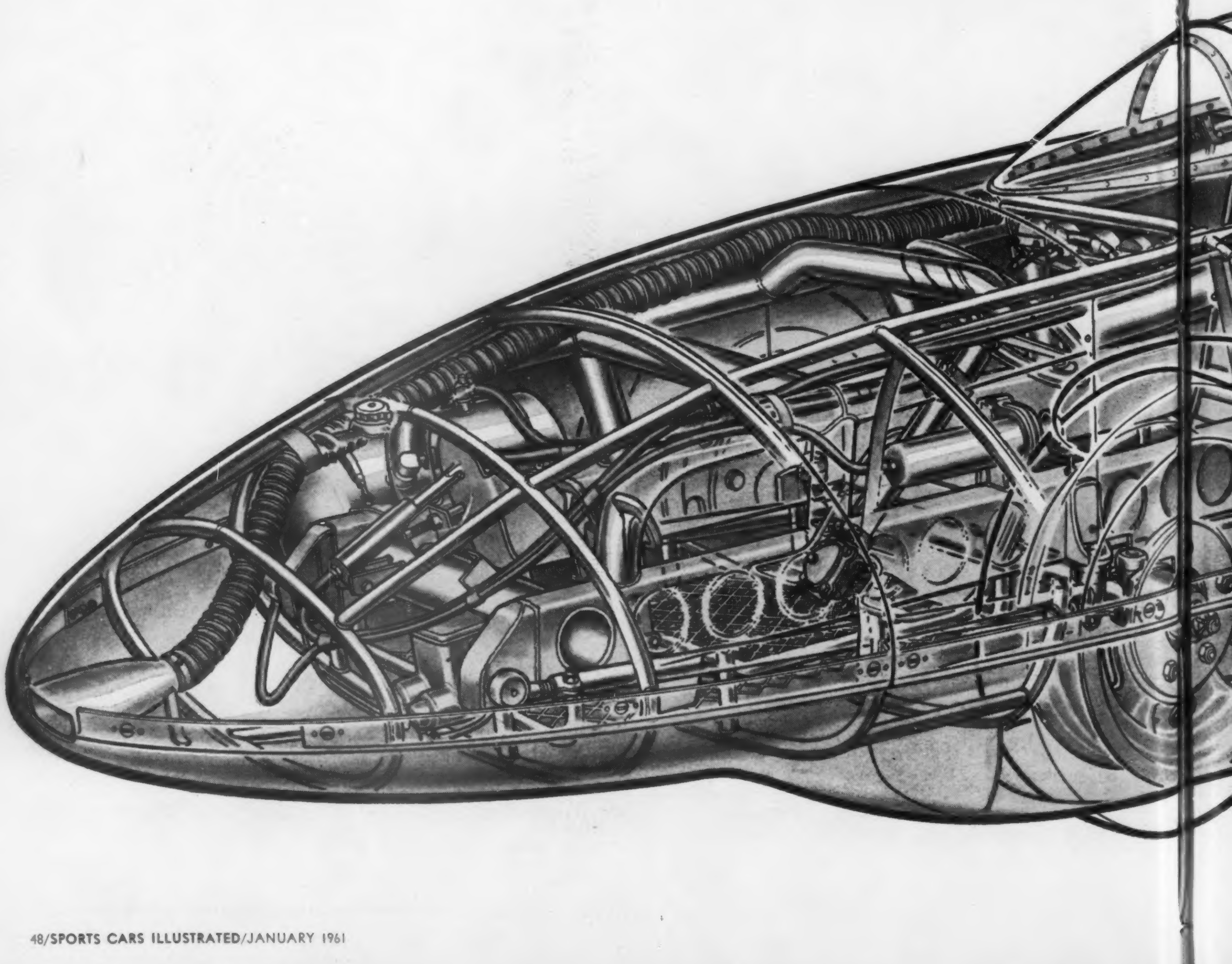
"SCI's advertising manager on the West Coast is amiable, vociferous Bill Burke. Burke has worked with high-performance machinery for most of his years and has left some historic marks on the sport. In 1947, for example, he invented the wing-tank-bodied lakester. Always interested in the challenge of going fast with few inches, Burke built a Class F streamliner (unsupercharged) in 1952 with which he set the Bonneville record of 136.90 mph, which still stands. When the first Cisitalia reached the coast it was Burke who snatched a fiberglass mold of the body before you could say Piero Dusio. And when John Fox brought the beautiful little Cooper streamliner to the Salt in '54 Burke could not resist making a mold of its shell although he had no distinct plans for its use."

We went on to tell how Burke, for years a non-participant on the salt, built a 'cycle-engine-powered chassis for the Cooper carbon copy to be run at the '59 Bonneville Nationals and how he turned a sick and dull 151.38 mph with 88 unhealthy cubic inches. That performance was disappointing but Burke returned from the salt richer in experience, knowledge and ideas. And with a determination to do much better.

Bill and I had many brain-storming sessions during the early stages of this project. His Cooper-Anticlimax was essentially a good machine, its potential yet untapped. But he had seen MG EX 181 and had been inspired. Throughout his years in racing circles Bill had had it dinned into his head by others that for stability at high speed you must have a broken body surface: the more bumps the better. His own instinct had always told him, though, that the ideal shape is that of a pumpkin seed. MG EX 181 confirmed this.

Burke wanted in the worst way to build a new machine that would be even smaller than the remarkably small MG streamliner. The fundamental problem was tires. The compactness of the Cooper-copy would not have been possible with the smallest highspeed Firestones then available. Their o.d. was 28 inches. New Goodyears with a 26.25-inch o.d.

"...After turning 205.97 in the first mile and shutting off,



made a big difference.

The 1959 racing season on the salt had revealed Goodyear as a giant among builders of fast tires. Thompson's tires were amazing for their small size and strength so we contacted Goodyear to determine if even smaller tires could be built for operation in the 200 to 300 mph range. We soon learned from Gene McMannis and Tony Webner that the firm was prepared to build low-profile, Thompson-type tires in 550x15 size with an o.d. of just 21 inches.

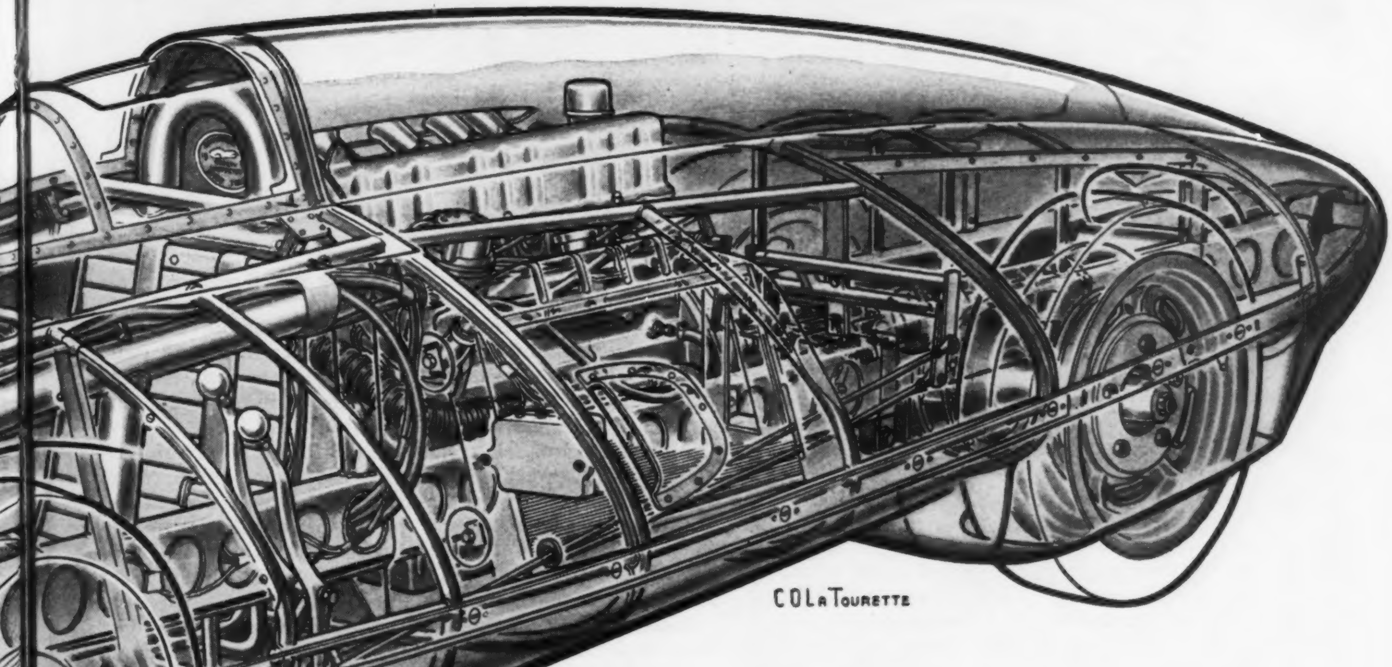
It is interesting to note that Thompson, in a rather direct way, was responsible for the realization of the new Burke machine. Goodyear did not dictate the tire size that Mickey would have to run on Challenger I. Mickey dictated the o.d. that he felt to be necessary to do the job. Goodyear found the means to meet his challenging demands and their solution was also the answer to Burke's problem, as it will be to more and more record seekers.

With tire size defined Burke was free to go ahead and sketch out a projected record machine with an 85-inch wheelbase and front and rear treads of 36 and 24 inches. The shell would have wheel bumps but they would be scarcely noticeable to eye or wind. In March of 1960 he turned his roughs over to Devin's Bob Till (designer of the SS and D Devins) who translated them into accurate eighth-scale drawings. On a periodic visit to New York Burke showed the drawings to Karl Ludvigsen who recognized the merits of the projected vehicle and convinced his management that SCI should help Burke bring the car to fruition.

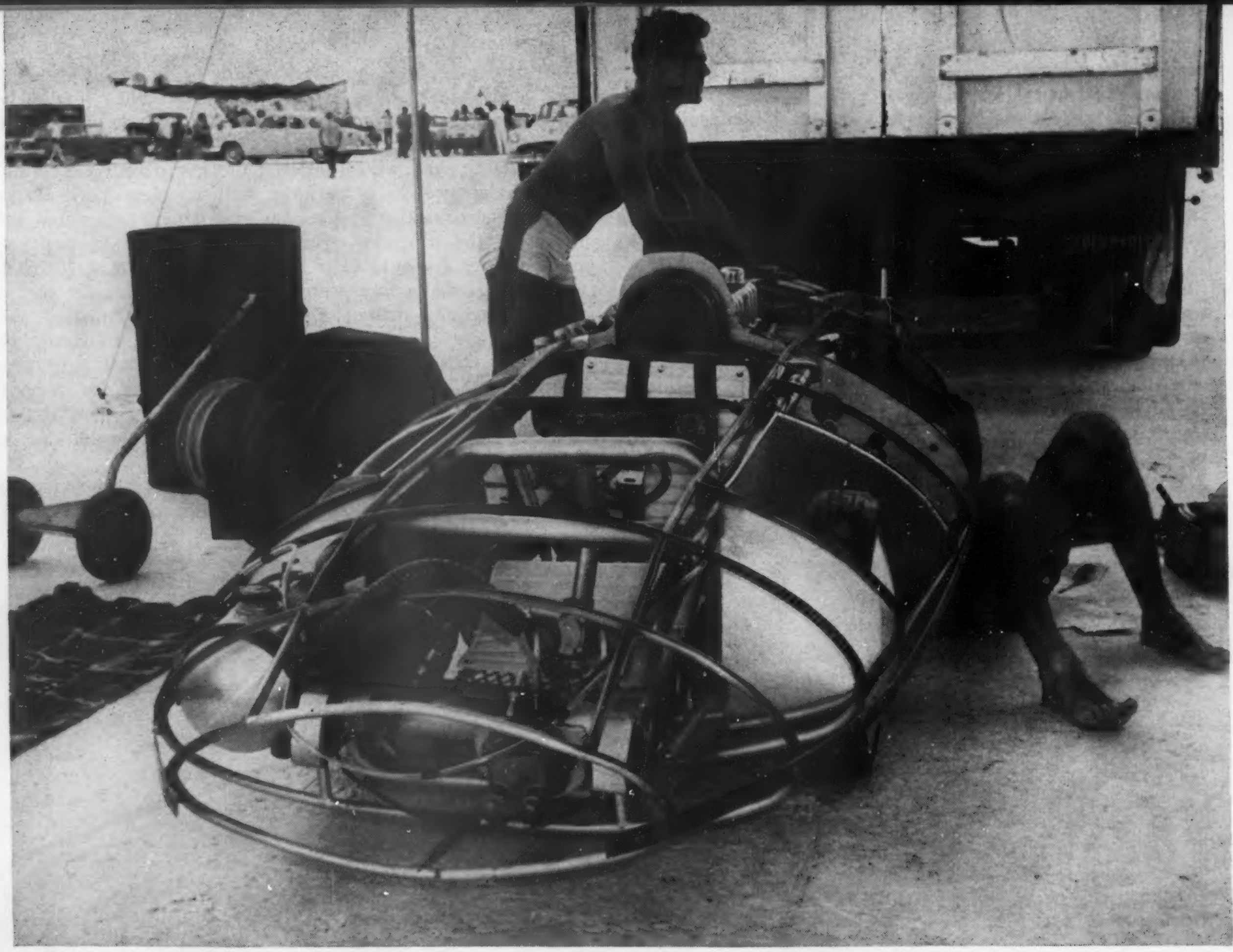
Power plants galore were suited to this vehicle and a choice was not made at this time. Burke turned the drawings over to Tony Stevens of Plastic Dynamics of Compton, California (manufacturer of fiberglass hard tops for sports cars) who literally put his plant at the disposal of the project. Stevens himself translated the drawings to plywood mockup, to male mold, to female mold and to final shell . . . a very time-consuming process.

Meanwhile Burke and his associate Bob Laster (sports car specialist and machinist with Halibrand Engineering)

the car clocked 205.14 in the second mile—coasting. . . ."



Bob Laster and Bill Burke, left to right, beam after the Sports Cars Illustrated streamliner sped across Bonneville's vast expanse to a new Class D Record of 205.949 miles per hour, bettering the existing ten-year old mark by over 43 miles per hour.



Uncluttered but extremely robust construction was a hallmark of SCI streamliner. Heavy tubing protected the driver who sat in semi-supine position.

built the chassis and frame. The running gear was detailed and fabricated by Chassis Research: chrome-moly tube front axle; Ford spindles; big ball-bearing Chassis Research hubs and 12-inch brakes; leading radius rods which operate in tension rather than compression; rubber-biscuit front suspension; Halibrand quick-change in a chopped Model A Ford rear axle; Crosley steering.

The frame was based on .125-wall, two-by-four-inch mild steel box rails and cross-members. Skin support was bent from electric conduit tubing and a sturdy roll cage was fabricated from heavy mild steel tubing.

At this stage the plan was to run a hot Devin-Panhard and/or a Formula Junior Sprite as prepared by Joe Huffaker of British Motor Car Distributors Ltd., in San Francisco. Then Burke became aware of a race-tuned Falcon which had been built up by Bill Stroppe and Associates of Long Beach. Stroppe learned his craft under Clay Smith in midgets, sprints, Indianapolis, stocks and the Mexican Road Races and therefore is awfully good and is surrounded by the finest talent. Burke approached Stroppe for the use of Falcon and Stroppe, sparkling, said, "Hell yes; let's go!"

Stroppe's fantastic plant in Long Beach is racing Headquarters for Autolite and happens to specialize in getting the ultimate out of FMC equipment. Vern Houle, another veteran of the Panam and pre-AMA-edict, all-out racing days, had lovingly built this engine with the dedicated help of Bobby Strahman.

People scoffed at Burke for his choice of a scrawny in-line six but he liked the engine and knew the abilities of the people responsible for it. Houle had bored the engine .125 for a displacement of 156 cubic inches. He had machined his own .090-oversize valves from stainless steel stock. Metal artist Ed Fletchall did the porting and manifold work to receive Hilborn injectors. Iskenderian ground the E2 cam and Joe Hunt supplied the Scintilla Vertex mag. Houle made his own pistons which produced a 10.6 compression ratio.

Everyone became interested in the little Falcon project. Dean Moon needed his dyno for the tuning of his own Bonneville engines. But he relinquished a solid week to Houle for the tuning of the Falcon, worked nights to help in its development. After careful tuning this team had the engine delivering 156 bhp on gasoline at 5200 rpm. On straight methanol it yielded 187 bhp at 6000 rpm.

Final assembly of the car began four weeks before the start of the Bonneville Nationals. The skin was mounted on the chassis two days before departure for the salt. When Burke and Laster arrived in Wendover they continued to build the car in the parking area of the Wendover Motel, SCI's Headquarters on the salt. The car's canopy was built there, in a plaster mold that had been carried in the record machine's trailer.

The schedule was so tight that the first run was made without the canopy. The old Xydias-Batchelor record of 162.95 had stood since 1950. Burke, head pinned in the wind, skimmed through the trap at 162.87, not dreaming that he was close to the record or he would have stood a little harder on the throttle. That was on Tuesday, on wet salt after the first deluge of the season.

Meanwhile, Laster had fabricated the canopy and overnight it was fitted to the shell. Burke streaked down the salt and his magneto shaft froze, tearing all the teeth off the cam. He returned to his pit at one p.m. and Houle and Strahman tore into the engine. Stroppe foresightedly had

brought along a spare Isky cam and at three p.m. Burke was back in line, waiting to go. He qualified to try for the record with 180.72 mph in the quarter-mile trap and 182.0 in the mile. The try took place Thursday morning with a one-way 187.50 mph and an average of 186.32.

Burke wanted to break 200 and so did the fine little engine but, running 2.11 cogs, he had run out of gear. Taller Halibrand gear sets were available but the center section would not accommodate them without being hogged out and no facilities for that operation were available.

"How about slightly bigger tires?" he asked Walt DeVinney of Goodyear on Friday morning.

"We can fly them out from Akron," he said, "but the meet ends tomorrow morning and you'll run out of time."

"You guys have been terrific," Burke said, "and I hate to ask it, but there are some skins with two inches more o.d. over in the Firestone tent. Would you feel badly if I used them?"

"You know better than that," DeVinney said. "Get 'em on there and go fast."

So Burke did. Still burning methanol he averaged a two-way 191, with 193 one way. He had broken the class record twice. Burke is a charger and yearned to run as far and fast as possible but Houle governed his running and Burke submitted to the authority of the man who had built the engine and, for example, balanced the volumes of its combustion chambers to within a tenth of a cc.

"You get to run just the quarter and the mile and then you shut off," Houle would state in his school-teacher way before each run. Being an arch-professional racing man Houle doesn't know the meaning of optimism and the streamliner's – and his engine's – mounting success left him typically impassive. For the first time, late Friday afternoon, he tipped the nitro jug, gave Burke a 25 percent charge and sent him off on a new qualifying attempt. There was, briefly, a trace of a smile on his lips when the voice on the p.a. said, with a note of historic emphasis, "the Falcon-engined SCI Special just turned two hundred and two miles an hour!"

Except for cool Houle there was general jubilation. Burke was walking a foot off the ground, blissful with the achievement and the car's perfect handling and performance. He had to wait until the following morning to try to make it two ways and was nervous. "Relax," Houle said. "It'll run."

Saturday morning Burke went north at just under 207 mph. Prior to that run Houle had said, "OK, now you get to stay on it until the two-mile marker . . . ONLY." This time, before the return run, he told Burke, "Today you live. Take it all three miles." He did, but the fuel pump pulley broke in the second mile. His two-way average and the new Class D record was 205.949 mph. When that was announced Houle was transformed into a leaping, shouting, hilarious kid.

Aerodynamically, Burke's car is an immense success. Its total resistance is so low that, to cite a typical example, after turning 205.97 in the first mile and shutting off the car clocked 205.14 mph in the second mile – *coasting*.

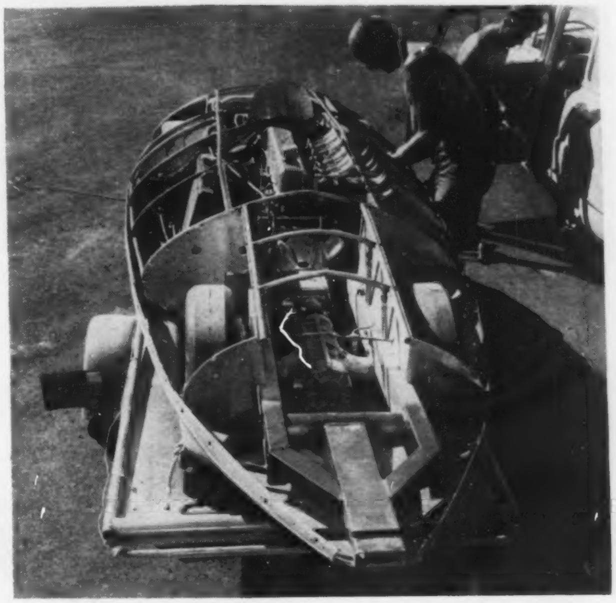
For Burke, a much more wonderful experience than shooting over the salt under power in this machine is coasting with the power off. The car wants to roll forever and the sensation of speed, space and silence has an otherworldly beauty.

After his 193-mph southbound run on Friday Burke was enjoying this rare form of hedonism and finally, reluctantly tapped the brake pedal. Nothing happened. A steel hydraulic line had been bent accidentally and had chosen this time to fracture. Burke had visions of crashing against the highway dike that forms the salt's south boundary.

"I was doing about 100 mph," Burke tells, "and was just about out of room as I went whistling by Mickey Thompson. He was working on his car and had his own problems but he saw that I was in trouble. He leaped into his pickup, came storming after me, got ahead of me and we flew through the row of phone poles like we were flat out and I guess he was. Then he led me through a little path that *he* knew of, through the impossible rough stuff and parallel to the highway. When I was down to about 20 mph he dashed ahead, jumped out of the truck and as I came by he flung himself on the car, grabbed its canopy and dragged it to a stop. I thanked him and all he said was, 'congratulations. You broke the record again.' Anybody knocks Mickey, I tell them that little story."

Burke has exciting plans for next year. —*GB*

Special Goodyear low-profile tires, mounted on Halibrand cast magnesium wheels, were used. Honeycomb construction was used for interior panels.



Burke and Laster make final adjustments before 200-mph runs. Hefty frame extension was for push starts. Unsprung rear end produced a bumpy ride.

BRAVIS

SSIMO!

Hail Phil Hill, the first American G.P. winner in 39 years! While the British stayed away, Ferrari staged a courageous high-speed-racing display at Monza.

by Jesse Alexander

► In a particularly bad show of sportsmanship, the English drivers boycotted the 1960 Grand Prix of Europe at Monza on September 4th; their absence gave Phil Hill an easy victory. Nevertheless, the books will now show him to be the first American to win a Grand Prix of Europe and the first American to win a *Grande Epreuve* since Jimmy Murphy won the French Grand Prix at Le Mans in 1921.

Hill's 131.77 mph average was three miles per hour faster than the last race on the controversial combined 6.2-mile Monza circuit in 1956. However, the record for the fastest European road course is still held by Spa-Francorchamps, where Brabham won this year at a speed of 133.33 mph. Had the English drivers been brave enough to come to Monza we would have witnessed a much faster race — a true race — rather than the farce that transpired and left everyone — even the winner — with a hollow, dissatisfied feeling.

EUROPEAN GRAND PRIX

September 4, 1960, Monza, Italy

50 laps, 6.2 miles per lap

1	Hill	Ferrari	2:21:09.2 (131.77 mph)
2	Ginther	Ferrari	2:23:36.8
3	Mairesse	Ferrari	1 lap behind
4	Cabianca	Cooper-Castellotti	2 laps behind
5	Von Trips	Ferrari F. 2	2:22:13.9 (126.78 mph)
6	Herrmann	Porsche F. 2	3 laps behind
7	Barth	Porsche F. 2	3 laps behind
8	Drogo	Cooper-Climax F. 2	5 laps behind
9	Seidel	Cooper-Climax F. 2	6 laps behind
10	Gamble	Behra-Porsche F. 2	9 laps behind

Fastest Lap

Hill, Ferrari, 2:43.6, 136.42 mph

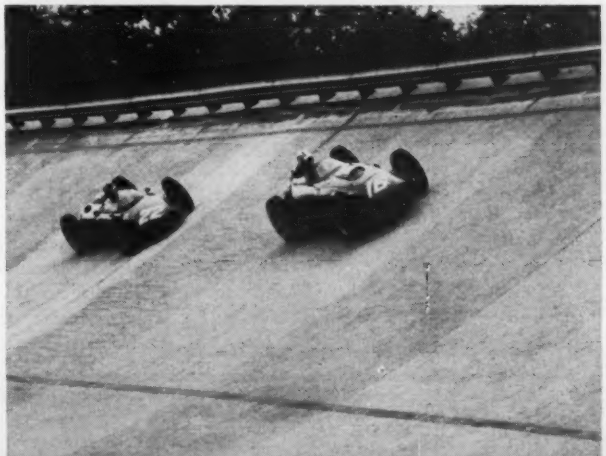
Averaging 135 mph around the combined Monza circuit presents a race car constructor with several problems. First, the banking is far from smooth. This, plus the tremendous centrifugal force, requires that much stiffer springs be fitted. The spring and shock absorber settings for the banking provide the departure point for adjusting the car for the fast road circuit, and the result is an unsatisfactory compromise.

Scuderia Ferrari had spent countless hours of testing at Monza and Modena in preparing both the front- and rear-engined cars for the race. Richie Ginther once went the entire race distance at Monza, and several official training laps at 136 mph by Hill and Ginther showed tire wear and temperature to be abnormally high. (During unofficial practice Hill turned a number of 140-mph laps in the rear-engined Ferrari.) This latter point resulted in considerable controversy during practice between the Dunlop people and Ferrari as to how often the race cars would be required to stop for tire changes. Dunlop, unwilling to allow the slightest risk to be taken, had the Formula 1 Ferraris stop twice; Hill changed five tires, the first time all but the left front, the second time only the two left tires. The Formula 2 Ferrari was called in once for tire inspection but was allowed to finish the race on its original set.

If the English drivers were conspicuous by their absence the constructors were not, for all of them came to Monza not to watch the race but to participate in a scheduled meeting of race car constructors. John Cooper had no doubt that his cars could last the distance on the combined Monza circuit with only minor alterations to the suspension, but he felt he could not force Jack Brabham and Bruce McLaren to race if they really felt the risks were unwarranted. In actual fact Cooper sincerely regretted the absence of his factory team. Colin Chapman felt that it was asking too much to prepare his team cars for the race "in the middle of the season" as he put it. The fact remains that three weeks intervened between Portugal and Monza but all the smoke put into the air by the drivers caused Cooper, Chapman and the B.R.M. people to lose interest, and Moss refused to drive at Monza if the banking was included in the race. The drivers all fell into line behind Moss and that was that.

Unpleasant stories circulated of actual threats being made to both Brian Naylor and Jack Fairman if they took part in the Grand Prix of Europe. Fairman was down to drive Horace Gould's venerable 250F Maserati but did not show and Gould did not have the *(Continued on page 92)*

Von Trips in the Formula 2 Ferrari stays close behind his "tow" car. It was driven by Mairesse during the race, and helped von Trips finish 5th.

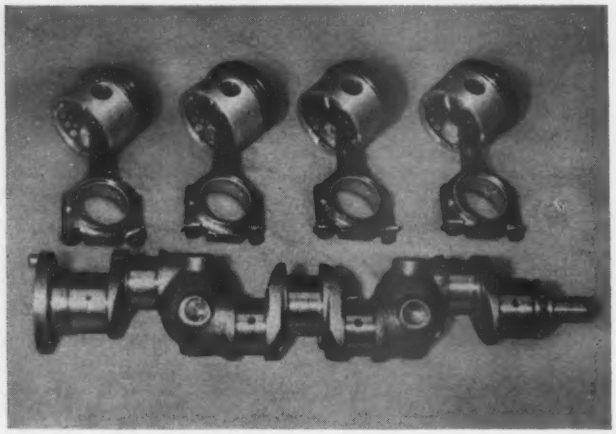


FORD ANGLIA 105E

► To those who cast little more than a hostile glance at each new expression of the local industry, the sight of a Dearborn U.S.A. design boomeranging from Dagenham, England comes as a disorienting shock. However, it *is* precisely the new Anglia's packaging, highlighted by the reverse-angle back window, which excited admiration everywhere. During the month we lived with this car, we found the female reaction almost invariably began, "It's so *cute*!"

The Anglia's lines do give it a strong personality. This is augmented by several other features. The bucket front seats with curved, form-fitting backs are excellent. So is the new-for-Ford four-speed transmission with floor shift. Shifting is positive and the synchromesh on the top three ratios is infallible. The car's fuel economy is splendid and, for the technically-aware, the engine is a delightful exercise in design. The super-short stroke is expected to be lengthened at least once for senior models soon to come.

TYPOND



Crankshaft, rods and pistons from Cosworth-tuned Anglia engine to be used in a Lotus F. Jr. illustrate the 105E engine's unusual oversquare dimensions. Hollow, cast-iron crank pictured here is completely stock.

Vision from the interior cannot be faulted. It benefits from the plunging hood line and the large back window, whose reverse angle minimizes frost and snow accumulations and permits a generously large trunk opening. The interior finish breaks completely with previous Anglia austerity. Upholstery is attractive two-tone vinyl and the seats are pleated. Room is quite adequate for four average-sized occupants and this includes leg room for the rear passengers. Four inches of seat adjustment are provided. Controls are nicely placed with a good instrument cluster directly before the driver which includes fuel and water temperature gauges. The speedometer, miracle of miracles, was spot-on. The horn button is on the end of the turn indicator lever, right at the driver's fingertips. It sounds a Lambretta-like *cheep, cheep*. There is a lockable glove compartment and an immensely handy parcel tray running the full width of the dash. The trunk has a fairly ample volume of 11¼ cubic feet. Access to the rear seat is slightly awkward, as with practically all two-door bodywork. But the car is best suited in America to town and suburban use, which means youngsters occupying the rear seat. In that case there's much to be said for deleting rear doors.

The new Anglia starts readily enough if you follow the instructions given in the owner's manual. The Solex starting device is unfamiliar to most Americans, and it requires that the driver use no throttle when the engine is cold, just full choke. Idle is smooth and there is a very sporting exhaust purr. The clutch is light and soft and first gear can be engaged quietly by the usual method of first putting the lever in the second position; lever travel is so short that this is easy. In the very low first ratio it is possible to squeak the tires on takeoff. The fact that double-clutching is required to get back into first while in motion is mainly of academic importance since second pulls strongly down to about eight miles per hour. Third, useful from 15 to 65 mph, is excellent for town traffic, for overtaking on the open road, and for pulling grades at brisk speeds. Top gear is flaccid and suited to contemplative motoring.

The radically-oversquare little 60.8-cubic-inch pushrod engine is notable for its tiny 1.9-inch stroke, and consequently its extremely low piston speed and internal friction. Efficiency and long life are furthered, respectively, by separate ports for each cylinder and a typically Ford oil filter built right around the oil pump. The hollow, cored-out cast-iron crankshaft derives from years of successful American and German Ford practice.

Although our test Anglia was fitted with the optional high-compression head (8.9 versus 7.5 to one) for which premium fuel is recommended, we burned regular throughout our test and had no detonation. Slightly quicker acceleration times probably could be obtained with higher octane fuel and an advanced spark but this car is being sold to the economy-conscious who will buy non-premium fuel if it does the job, which it does.

The late Summer in Southern California was extremely hot and the Anglia engine ran always with its coolant temperature needle close to the red band. In 100-degree heat, boiling threatened on moderate grades. For warm climate use, EnFo would do well to provide a fan with more than two blades; perhaps they do but it's not mentioned in the manual. What is mentioned are 13 points to be greased every 1000 miles.

The little engine is wound about as tightly as it wants at 5700 rpm. The car's terminal velocity is about 74 mph or 4600 rpm which is nothing at all in terms of piston speed or loading of the valve train. It will zip along flat-out all day, which is how we drove it whenever we could. When we couldn't, we played arpeggios on the gearbox. Our fuel consumption on an 80-mile, full-bore run was 29.7 mpg. Now, if one chose to drive this car for economy . . . .

The ride is good but mushier than, for example, the fine Ford Consul of the early 1950s. Steering is precise and handling is OK but uninteresting. You can enter one in a production car event if you want but it would not be our choice. On rough turns or steep, bumpy climbs, the weight of the rigid rear axle makes it hard for the rear wheels to stay on the ground, thus reducing cornering ability and traction. In this it's better than its predecessor, having softer rear springs. The brakes are quite good, being nearly devoid of fade at the end of ten stops from 60.

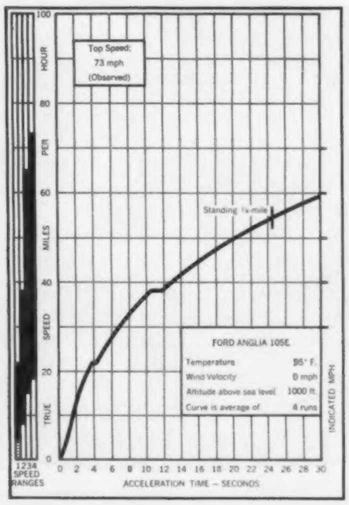
We disagree with a contemporary who remarked that the new Anglia is relatively insensitive to side winds. It gets knocked about and reacts suddenly. If you want ventilation in the car, you must accept wind buffeting; there is no combination of window openings that will prevent it. Our test car's final-drive gears were noisy and the drive shaft U-joint clunked.

The new Anglia is priced as competitively as any economy import on the market. Having much of the dealer and service body of Ford's M-E-L (what's that "E" still doing in there?) Division behind it, service should be good. It's a nice car and one to be tested personally if you're shopping that market. *—Griff Borgeson*

ROAD TEST

FORD ANGLIA 105E

Price as tested:	**$1608 POE**
Importer:	**M-E-L Division Ford Motor Co. Dearborn, Michigan**



ENGINE:

Displacement	60.8 cu in, 997 cc
Dimensions	Four cyl, 3.19 x 1.91 in
Compression Ratio	8.9 to one (7.5 optional)
Power (SAE)	41 bhp @ 5000 rpm
Torque	53 lb-ft @ 2700 rpm
Usable rpm Range	1200-5700 rpm
Piston Speed ÷ $\sqrt{s/b}$ @ rated power	2055 ft/min
Fuel Recommended	Regular
Mileage	29-37 mpg
Range	240-310 miles

CHASSIS:

Wheelbase	90½ in
Tread, F, R	46 in
Length	153½ in
Suspension:	F, ind., coil-strut, lower wishbone, anti-roll bar; R, rigid axle, semi-elliptic leaf springs.
Turns to Full Lock	1.3
Tire Size	5.20 x 13
Swept Braking Area	126 sq in
Curb Weight (full tank)	1690 lbs
Percentage on Driving Wheels	45%
Test Weight	1860 lbs

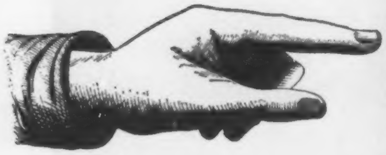
DRIVE TRAIN:

Gear	Synchro?	Ratio	Step	Overall	Mph per 1000 rpm
Rev	No	5.30		22.29	3.0
1st	No	4.11		16.99	3.9
			72%		
2nd	Yes	2.40		9.88	6.7
			70%		
3rd	Yes	1.41		5.83	11.4
			41%		
4th	Yes	1.00		4.13	16.1

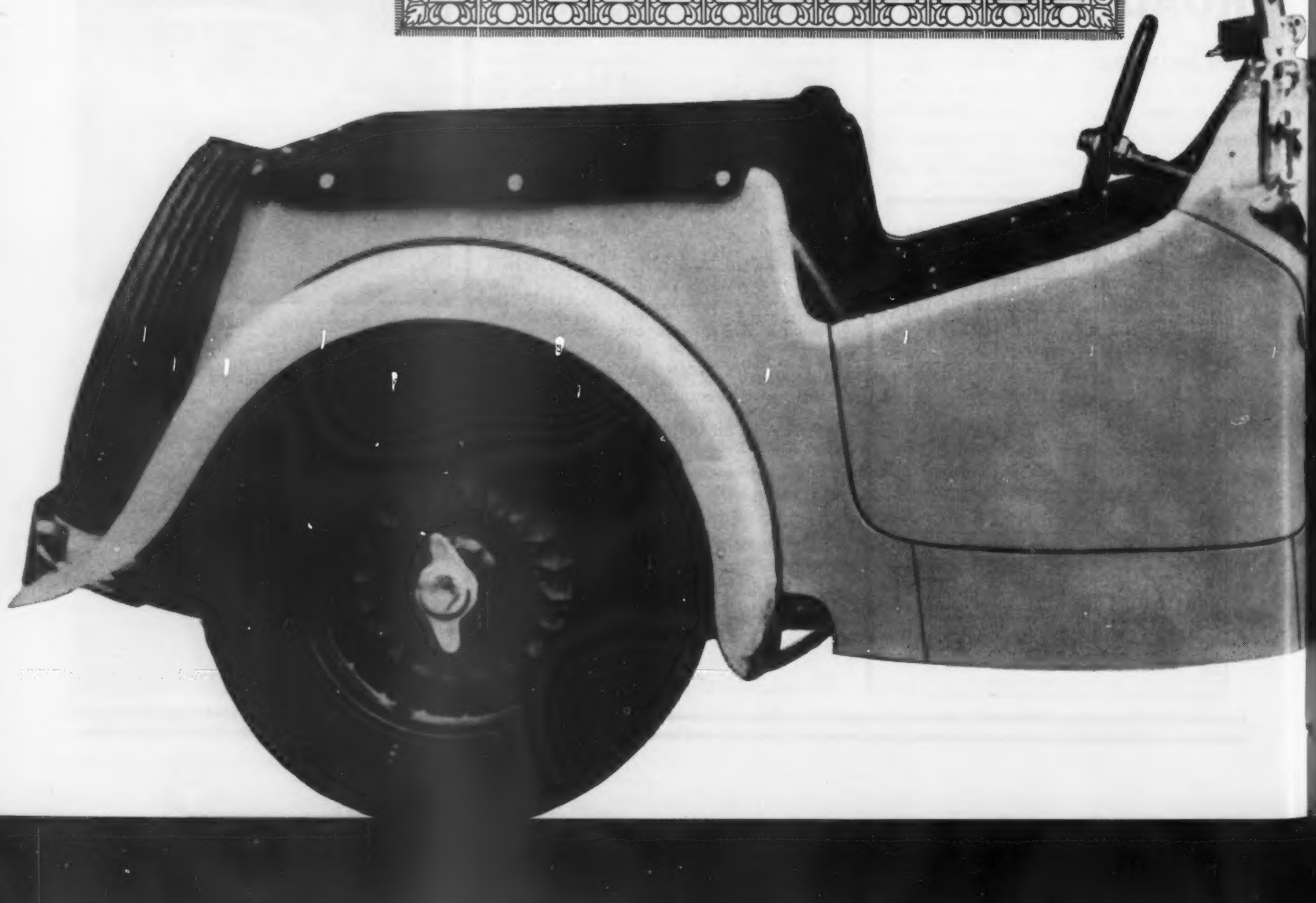
Final Drive Ratio: 4.125 to one.

by Dennis May

HURGS WERE FOR HURRYING



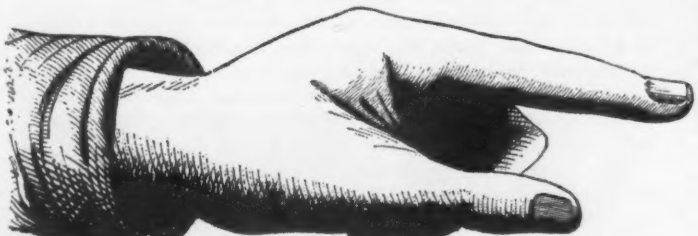
This G.N. and later H.R.G.s were created by H. R. Godfrey, who built cars for avidly masochistic males.



▶ If Senator Daniel Webster hadn't coined the axiom "the past at least is secure," H. R. Godfrey would likely have done so a century later. In 1936, the year Godfrey and partners launched the H.R.G. sports car at Tolworth, England, a minor convulsion in automobile design was underway. Front suspension was going independent; springs at both ends of the ladder were suppling up; engines were shifting forward, supposedly improving fore/aft weight distribution and anyway filling in the vacant lot the dumb-irons of yore had enclosed; piped fluid was fast superceding rods or cables for brake operation; the radiator, naked and unashamed since the dawn of automobilism, was donning a decent bra of slats or meshwork.

But Edward Athelstan Halford, Guy Robins and Henry Ronald Godfrey – to place the partners in the order their surname initials spelt H.R.G., though not in order of importance – looked askance at these concepts. What was good enough for Aston Martin, Frazer-Nash and others of this diehard ilk, they decided, was good enough for them. So the H.R.G. came into the world with a beam front axle, a spring periodicity approximately equal to that of the chassis girders themselves, far-back engine placement, mechanically operated brakes and a radiator-shaped radiator that bared its bosom to the breeze. The past at least was secure.

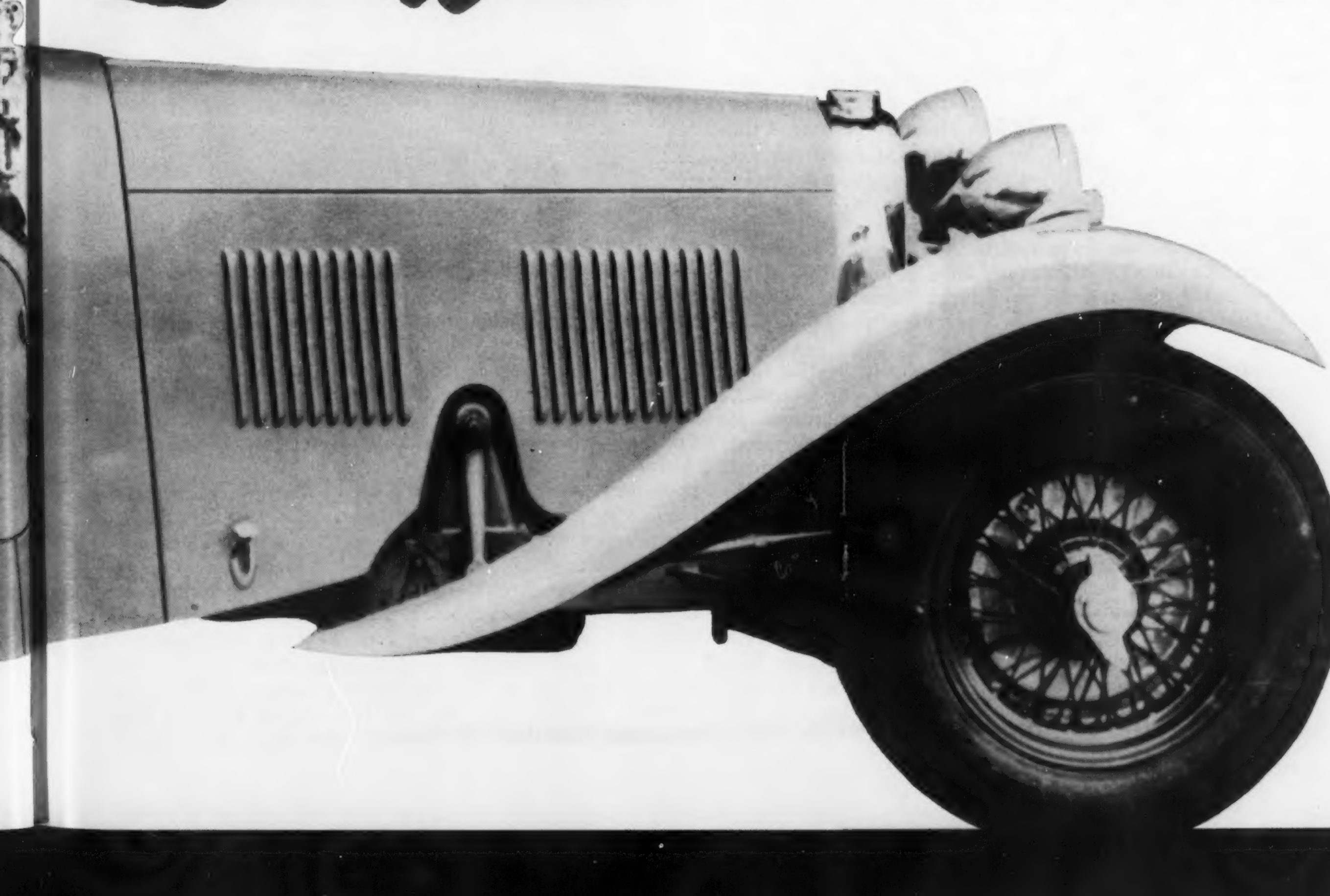
Let's not be too wise after the event, however, because Messrs. H., R. and G., although conservative, were no fools. They believed there'd be a market for the car they had designed with their eyes on the mirror of hindsight rather than the telescope of foresight, and there was; the Sportsman's Ideal, as the H.R.G. was proudly proclaimed on the catalog covers, consistently sold over a period of two decades (with the war years subtracted) in numbers coinciding comfortably with its makers' modest ambitions and the capacity of their small factory. The *marque* became a byword for versatility. As Godfrey wrote in a capsuled history of his handiwork: "It was claimed that the owner of an H.R.G. could use his car for everyday motoring and also indulge in trials, hillclimbs and races with success." He not only claimed it – it came to pass.



The allusion to *owners* indulging in competition was calculated. H.R.G. itself neither took part in nor supported racing – a fact that lends special value to the make's far from negligible record in competition. The odd thing about it, moreover, was this: prewar, when the design, if technically cautious, was at least new, H.R.G.s never scored a single win in an international contest to the best of my memory, whereas in the late Forties, when the basic blueprint was both old *and* obsolete, owner-driven Hurgs, as they were affectionately known, pulled off a series of international

Eric Thompson in the much-modified H.R.G. that won the 1500 cc class at Le Mans in 1949. It was affectionately called the "Mobile Galosh."

successes that made history of a curious kind. These included the King of the Belgians' prize for the best-placed team regardless of displacement in the 1948 Spa 24-hours race; first, second and third placement in their class (1½ liters) at



Spa the following year; a class win and eighth on general order at Le Mans, 1949, and, in another but equally rigorous field, a Coupe des Alpes and two out of three team awards (they weren't eligible for the third one) in the '48 Alpine Trial.

An apologist for H.R.G., having listed this almost startling take, would let it go at that, but we've said it made history of a curious kind and the remark calls for explanation. *Prima facie,* you'd gather from such evidence the Hurgs at Spa and Le Mans were fast and reliable cars, whereas, to be brutally truthful, they were slow and merely less fragile than the opposition. I saw all the races in question, and incidentally drove a considerable mileage on the most successful Spa *cum* Le Mans car, so I know what I'm saying. First, let's take a look at the Belgian marathons.

In 1948 – to put the question of relative speeds into focus – the leading H.R.G. covered 23 laps less than the class-winning Simca, a deficit of 228 miles, and the tailender on the Hurg team fell short of the Simca by no less than 56

THE MOTOR, LONDON

The author behind the wheel of a 1938 example of the make. Pushed-back engine mounting gave car its lean, ready-to-spring appearance.

laps. No doubt the Belgian king came across with his cup with a pretty wry face, but he had to give it to the Englishmen because no other team finished intact. Anyway, however sedate the pace of the British cars, *qua* cars, the drivers at least earned a regal nod for a considerable feat of stamina and tenacity. This was one of the wettest races I ever watched, run in an almost nonstop deluge. It was, as far as I know, the only car race in history where a driver came near to death by drowning: a fellow named Bouchard overturned his Delahaye in a ditch, breaking both arms and legs, and was pinned under the car with his head submerged in a foot of water. Fortunately only about 90 percent of the spectators had taken refuge in the bars, so Bouchard was spotted and rescued while there still was breath in his body.

The H.R.G. contingent had quite a time of it too. The team leader, Peter Clark, stoically lifted his cylinder head four times to replace leaky gaskets. And the only coupe on the team, Ray Brock's car, literally blew its top, finishing the race with no roof and no windshield. Nonetheless, three H.R.G.s started and three finished, placing second, third and fourth.

A year later, they did better still statistically, fielding four cars and again achieving 100 percent survival – first, second, third, fourth in their class. The winning Hurg partnership, however – Eric Thompson and Jack Fairman – averaged nearly 6 mph less in fair weather than the Simca had turned in the '48 downpour. Along the way, the Thompson car had wholly or partially shed three out of its four main body panels, almost lost its tail section (the pit reattached it *al fresco* with a broomstick and clothesline), dropped a headlamp and broke its fuel tank mountings. One of the other H.R.G.s, which eventually placed fourth and last in its class, became so short of breath that its codrivers, Clark and Goodall, contented themselves with turning one nine-mile lap per hour for a considerable spell. If the rules hadn't set one hour as the permissible maximum for a lap, no doubt they'd have eased further.

The 1½-liter-class wins at Le Mans and Spa were scored by the same car – NPB71 – and the same drivers, and these two 24-hour races came off only two weeks apart. Furthermore, NPB71 went straight from Le Mans to Spa without having a wrench laid on it. On the other hand it could be argued that all the forseeable necessary servicing and rejuvenation had been done *at* Le Mans, actually in the course of *Les Vingt-Quatre Heures.* There, after Thompson, as the number one driver, was left at the takeoff for a small eternity, viz., two minutes, with an engine that wouldn't start, this sour omen was abundantly fulfilled. During pit operations on the cooling system, a mechanic was painfully scalded. In spite of the provision of a hand-wheel brake adjuster within reach of the driver – this was a traditional H.R.G. feature – Thompson and Fairman later found themselves totally bankrupt of brakes and stayed that way for five hours. In all, then, it wasn't surprising their 1949 average, 70.7 mph, fell short of Aston Martin's fourteen-year-old class record by almost 5 mph. (It's further worth noting that between 1949 and 1958, when the Barth-Frere Porsche went 2420 miles in 24 hours, 1500 cc speeds rose by 30 mph at Le Mans.)

But if these hollow victories at Spa and Le Mans put the individual cars into rather a dim light, it's relevant to add they'd been the subject of drastic makeovers in which H.R.G. itself played no part. The chassis had been much lightened, much of the equipment was nonstandard, the special featherweight bodies – unrecognizable as H.R.G. – weighed as little as 50 pounds. This heavy-handed pruning in the body department was indeed a weapon with a penchant for self-inflicted wounds; the sequence of events went as follows: body flexes, lets chassis flex, flexing chassis further warps body, body starts breaking up. At Le Mans, incidentally, with the aid of judicious slipstreaming, Thompson was hitting 106 mph along the Mulsanne Straight and turned a best lap of 6 minutes 22 seconds.

These 1949 Hurgs were entered by Peter Clark and built by a firm called Monaco Engineering under the direction of, interestingly enough, John Wyer, who later became David Brown's team manager at Aston Martin and is now the company's technical director. They had single-o.h.c. Singer engines with four cylinders measuring 69 by 103 mm, sodium-cooled vertical valves, bronze valve guides, enlarged exhaust ports, balanced and polished con-rods, oversize cranks to H.R.G. specification, dual S.U. carbs, a Lucas vertical magneto, a light-alloy radiator. Capacity of the alloy fuel tank was around 22 U.S. gallons.

What happened to NPB71 after Eric Thompson sold it I don't know, but I shouldn't think any subsequent owner would have dared race it for fear of spoiling its 100 percent success record. While Eric owned it, it contested four races, heading its class at Le Mans and Spa, as already noted, and winning both the others outright. These were at Goodwood, over short distances.

Thompson, who was later elevated to the Aston Martin factory team and co-drove a DB2 into third place at Le Mans in '51, lent me NPB71 at the end of its eventful and ambiguously triumphant 1949 season. Writing about it in The Autocar, I see I said, with reference to its unrelenting suspension: "'Springs' is more or less a courtesy title for the laminated appendages at each corner of the car. Consequently the vehicle as a whole receives some rude shocks when rude and shocking surfaces are traversed . . . On the other hand, when official springs deflect so grudgingly and so little, something else, viz., a pair of invisible springs about halfway along the side members, have to flex instead."

On the credit side, the piece went on: "I have driven few vehicles that can be wooshed around corners quicker than NPB71 . . . you brace your left foot against a special stop projecting from the bell housing, your right knee into a

sponge rubber pad on the inside of the body, your back into the squab — and just lay on the lock until everything starts sliding . . . It seems quite a shame you can't slide it along the straight."

William Boddy, editor of MOTOR SPORT, to whom Peter Clark lent NPB71's twin, thought "this car might be more suited to those who have had their appendix removed than to those who have not." The rest of his report was mostly enthusiastic — this was just his oblique way of saying the Hurg nearly shook the guts out of him.

If you don't count a very advanced H.R.G. that was stillborn in 1956, to which we'll return later, the original 1936 design concept lasted the *marque's* lifetime. In twenty years, virtually the only engineering developments were the introduction in 1939 of an 1100 cc Singer engine model with single o.h.c., to supplement the staple 1½-liter type with rockerbox Meadows powerplant; a postwar switch to Singer engines and gearboxes on both sizes of Hurg, and, in the late Forties, the adoption of a shorter-stroke version of the larger Singer engine in conjunction with a hypoid back axle in place of a spiral bevel. To the naked eye, prewar and postwar H.R.G.s are distinguishable because the former has a visible slab tank like a TC Midget's and the latter hasn't; it's still slab but, as a concession to whatever word takes the place of "styling" in H.R.G. terminology, it is enclosed in the rump of the body. There never was an H.R.G. with more than two seats.

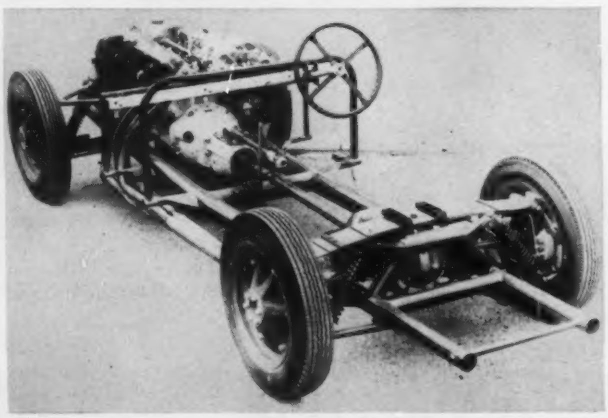
If you ever owned or drove an H.R.G., and if you furthermore had a soul, you wouldn't need to seek a *raison d'etre* for the make's existence. But as the all-time output amounted to less than 400 cars, the chances are you never did own or drive one, so let's take a dip into Mr. Godfrey's own monograph on the make for our *raison d'etre*:

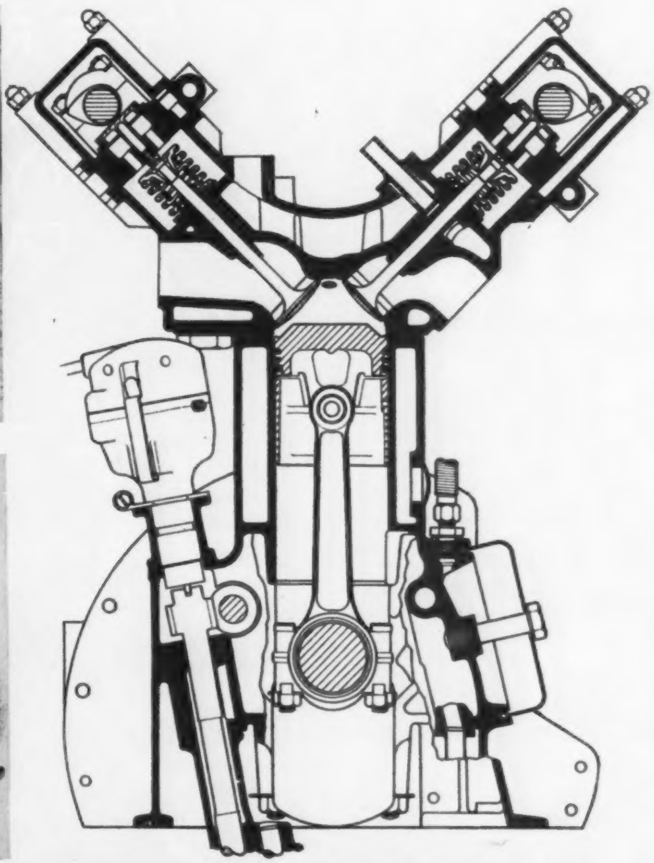
"During the early '30s, little attention had been paid to sports cars in Britain, as manufacturers had been concentrating on the production of family saloons . . . In consequence, with a few very expensive exceptions, sports cars were poor both in performance and handling characteristics . . . Their chief faults were: too much weight in relation to engine capacity, soggy steering, poor road holding due to lack of lateral rigidity of chassis and excess of unsprung weight, small-diameter brakes."

These failings, or anyway most of them, were certainly eliminated in the prototype H.R.G., which was designed by Ron Godfrey in 1935 and built by the partners in person with the help of one laborer. The following year, with practically no alteration, the design went into production, immediately receiving near-rave notices from the press.

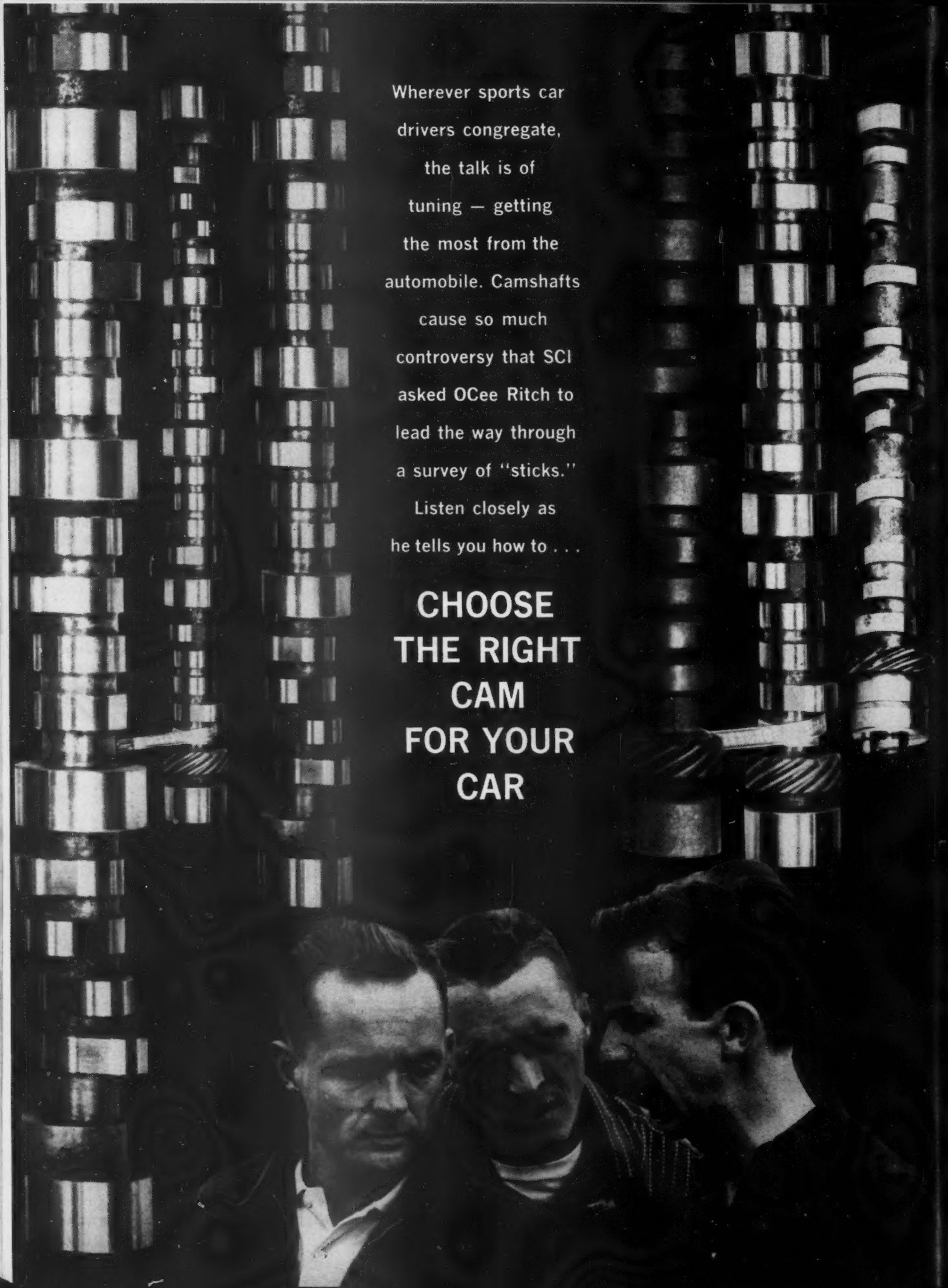
The Hurg was light — by the standards of its day — because it was simple. Inherently, the 69 x 100 mm Meadows engine, of 1496 cc, and its accompanying crash-type four-speed gearbox, were fairly heavy items, but elsewhere there wasn't a superfluous ounce of metal. The frame consisted of two closely-spaced and parallel side members, 4½ inches deep, perfectly straight except for a slight dip that carried them under the back axle, and adequately cross-tied. The rear springs were semi-elliptic, the fronts quarter-elliptic with the arms of a pair of friction shocks acting as radius rods and so relieving the springs themselves of brake torque.

To cut unsprung weight, the front axle was tubular and the brakes, designed and made by H.R.G., had finned magnesium drums, cast iron liners and (*Continued on page* 90)





Post-war—1956—H.R.G. was stillborn when Rootes combine scrapped Singer engine on which car was based. Design included disc brakes, twin-cam head.



Wherever sports car drivers congregate, the talk is of tuning — getting the most from the automobile. Camshafts cause so much controversy that SCI asked OCee Ritch to lead the way through a survey of "sticks." Listen closely as he tells you how to . . .

CHOOSE THE RIGHT CAM FOR YOUR CAR

► The cam, being a kind of half-way point between bolt-on and build-up, has suffered (or gained) from more attention paid by the semi-engineer-mechanic-designer than any portion of the internal combustion engine. Only heads and manifolds could rival cams in popularity with the backyard experimenters through the Model T, Model A and flathead Ford V8 days in the United States. After all, it didn't cost much to cut and try. The factory was providing all the raw material you could use up at a reasonable price. And, chances were, if you wanted to set up as a cam grinder nobody in the neighborhood could challenge your theories . . . particularly if you copied a well-tried pattern.

While phalanxes of white shirt and bow tie engineers labored over their drawing boards aimed at mathematical perfection, some yuk out in the boondocks was apt to luck into a grind that would stand the gentry on its ear. At least, that's the way we used to look at it, and we all hoped to be that yuk. Once in a while an isolated student of the art would possess a copy of the AUTOMOBILE ENGINEER's HANDBOOK or an equivalent volume and he would stumble onto the data that told him what he had been doing.

Until extremely recently most passenger car *and sports car* (let's face the facts, men) cams were ground on the three-arc or harmonic principle which utilizes (in effect) a small-diameter circle superposed on a larger-diameter circle and connected by larger radii. The parts are, respectively: nose, base and flanks.

The base circle represents the portion of the cam which contacts the follower (tappet) when the valve is closed and resting on its seat in the head (or block, as the case may be). The nose is that segment which holds the valve open at its maximum aperture. The flanks impart lifting motion on one side and control the returning action of the valve spring on the other.

A simple piece, you say? In concept, yes. In refinement, capable of extremely critical minute variants.

THE CRUX: ACCELERATION

As long as our predecessors were dealing with large, slow-moving reciprocating masses, the valve-lifting mechanism could be equally crude. But when higher output from smaller displacement and lighter weight became the norm and when the revs began to climb, sophistication in cam design had to follow. Either the flathead or the o.h.c. with a short, stiff valve train (a simple follower, spring and keeper) requiring only light spring tensions is really a cam grinder's dream. They present no problems or very few, when compared to the long pushrods, rocker arms and monkey motion found under most bonnets these days.

Even with the side valve, however, serious experimenters were discovering the weird effects of acceleration. Not acceleration of the car. Acceleration of the valve train, which greatly exceeds 10,000 ft/sec^2.

When the radius of the base circle of the cam begins to blend into the opening flank, the valve starts to leave the seat. The mass of the valve is set in motion instantaneously and then must be raised with sufficient velocity to attain maximum opening within a certain period of time. But during the period when the valve is riding up the flank and being raised to the nose, it does not lift at a constant velocity. It is first accelerated and then decelerated.

To draw a quick analogy: have you ever picked up a tool box from the ground and lifted it into the trunk of your car, or the floor of your station wagon? Of course. Well, think about it. You raised it off the ground first rather gently, found it wasn't too heavy, picked it up swiftly, brought it to the top of an arc and then lowered it into the car. At first the box was being accelerated, but as you got it nearly to the height sufficient to clear the deck you eased up and actually *decelerated* the mass although it was still rising. Lowering it to the floor of the car was more of the same; acceleration as you let gravity take over, then deceleration to avoid a loud clatter.

Now, go back to the cam and the valve and interpose all these mechanical adjuncts; follower, pushrod, spring, rocker arm and shaft, which complicate the situation in a typical o.h.v. engine. You will find mass represented by the tappet and pushrod, which must be lifted against gravity. The rocker arm is also overbalanced toward the pushrod and often held by a spring. The valve, sustained by its spring, goes with gravity. Now, let's picture what happens when the cam rotates: first, the tappet, pushrod and rocker arm must be set in motion to take up the valve clearance. Then, upon meeting the resistance of the valve spring, a certain amount of compression takes place and there is a degree of bounce-back. Pressure continues to be exerted, the spring is compressed and the valve leaves the seat. There is a need to get the valve open quickly, so it is accelerated smartly. Inertia overcome, the effects of setting this weight in motion now begin to be felt and the valve wants to keep right on going like a batted baseball. But, at this point, the acceleration must be tapered off to take advantage of the maximum lift period which is coming up. The spring, too, which has alternately resisted the cam pressure and gone alone with it as accelerated mass, is behaving in accordance with harmonic vibration laws (like a violin string), singing a tune unrelated to the rest of the symphony.

In the old designs, the valve train was accelerated right up to the point where the nose radius took over. The result, as might be expected, was that engine speed was severely limited because the valves had a tendency to keep right on going into orbit. Increasing spring tension to counteract this effect resulted in excessive valve seat wear, lobe and lifter scoring plus the threat of broken coils. And the closer the cam grinder tried to get to the ideal of having the valve open to its maximum lift instantaneously, the more pronounced the problem became. It was at this point that variable-acceleration theories came into being and the formulae for plotting a lobe according to physics appeared.

SURPRISING LIFT PATTERN

Plotting amount of lift in relation to degrees of rotation results in a graph on paper which can be expressed mathematically. By working backward, it is possible to lay out, according to an equation (or equations), a desired contour. The contour to be sought is one which will induce the valve and its related components to move in a manner that will remain constant throughout the engine's rpm range. To be included in any equation are the necessary corrections for valve train flexibility. Also to be considered are spring rates which ideally should be high enough not to excite the harmonics of the cam motion.

What has been accomplished by trial and error as well as at the drawing board, with the best high-performance cams, is that a valve moves in anything but a straight-line acceleration pattern. Slack is first taken out of the train and the components set in motion with less acceleration than was typical of the constant-eccentricity type. The rate is then picked up. A period of lesser acceleration follows to ease off on the spring. Then, with the spring on the rebound, so to speak, a swift lift to maximum flank acceleration is effected.

Deceleration, zero velocity and re-acceleration-deceleration for the closing cycle are repeated farther along the contour.

We have dealt with a rather advanced part of the course first because the mechanics of making the valve train stay on the right track are now more important than variations of the opening-closing cycle which influence engine performance. So many of the infinite number of functions of this wave have been explored since the post-war boom in hot cams that progress is being measured in ever-diminishing increments. In short, with every passing day the yuk out

(*Continued on page 64; chart overleaf*)

SPORTS CAR CAMSHAFT COMPARISON CHART

This listing is a guide to valve timing for the more popular sports cars, and permits interesting comparisons to be made. A point to remember, however, is that manufacturers generally measure valve timing with larger valve clearances than are actually used for running the engine. How much larger varies considerably. Extreme examples are the VW which runs at .004 but is checked at .039 and the Sprite which runs at .012 and is checked for timing at .019. Therefore different engines might seem to differ by as much as ten degrees yet have essentially identical timing. Valve lift can be changed without altering the camshaft by using rocker arms of different proportions to get faster, greater lift.

This list of reground cams gives a comparison of the grinders' approaches to a problem and is not intended as a catalog. Among the many cam grinders, one can find special cams for nearly every popular sports or economy car. Some addresses:

Iskenderian Racing Cams, 607 North Inglewood Ave., Inglewood, Calif.
Weber Tool Company, 2990 Ramona Blvd., Los Angeles 33, Calif.
Crower-Schneider, 3669 California St., San Diego 1, Calif.
Camshaft Engineering Co., 8687 Melrose Ave., Los Angeles 46, Calif.

CAR	INTAKE Open BTDC	INTAKE Close ABDC	EXHAUST Open BBDC	EXHAUST Close ATDC	VALVE LIFT
A.C. Ace	12½°	50°	55°	20°	.375
A.C. Ace Bristol	16½	56½	56½	16½	.343
ALFA ROMEO Giulietta	25	68	61	19	.315
ALFA ROMEO Veloce Veloce cam extends rpm range.	39	63	63	30	.334
ARNOLT BRISTOL	40	80	80	40	.343
ASTON MARTIN DB4	28	68	62	22	.450
AUSTIN-HEALEY Four	5	45	40	10	.390
Factory option for improved torque 4000-5000 rpm; part number 1B.2892.	10	50	45	15	NA
Iskenderian 295 ¾ Race; idle smooth; 12% bhp boost claimed. C.r. should be increased one point.	10	50	45	15	.420
Iskenderian S-221; needs tubular pushrods chilled lifters, heavy retainers and special springs; track use only.	20	60	55	25	.470
Weber Road Race; o.k. for street, idles rough; good for 6500 rpm; spring shims required.	24	58	58	24	.409
AUSTIN-HEALEY Six	5	45	40	10	.356
Factory option for improved torque 4000-5000 rpm; part number H.8339.	16	56	51	21	NA
Weber Full Race: o.k. for street, idles rough; good for 6500 rpm with stock pushrods and lifters; shims required.	23	57	57	23	.409
AUSTIN-HEALEY Sprite	5	45	40	10	.280
Factory option; more g[illegible] at 4500-5500 rpm; long cam life.	16	56	51	21	.312
Iskenderian MM-55 Track; good power 4000-8000 rpm; needs special springs; lifters o.k.; can go on street.	20	60	60	20	.325
Iskenderian MM-32 Street; High power curve from 3500-7000 rpm; special springs recommended.	18	59	60	20	.310
Weber Full Race; o.k. for street; bhp increased and moved up; 6500 rpm limit with spacers; low end not affected.	20	60	55	25	.300
BMW 507	38	73	73	38	.315
CORVETTE 867	12½	57½	54½	15½	.399
Factory option, Duntov cam; slightly deficient in low rpm torque, but easy on valve train.	35	72	76	31	.394 i .400 e (.382 before '59)
[illegible]	28	58	58	28	.372

CAR	INTAKE Open BTDC	INTAKE Close ABDC	EXHAUST Open BBDC	EXHAUST Close ATDC	VALVE LIFT
DEUTSCH BONNET HBR-750/850	16	60	60	16	NA
Factory option.	13	66	57	21	NA
DENZEL	15	55	55	15	.364
FERRARI 250/GT Coupe	27	69	73	17	.354
FERRARI Berlinetta	42	72	70	40	.398 i .394 e
FERRARI Testa Rossa	43	75	70	40	.398 i .394 e
FIAT ABARTH	30	70	70	30	.354
JAGUAR (all)	15	57	57	15	.375
XK 120, more bhp at top end.	15	57	57	15	.432
LANCIA Aurelia	22	82	55	23	.296
MERCEDES-BENZ 300SL	54	92	74	36	.370
MERCEDES-BENZ 190SL	44	87	81	42	.374
MG TC, TD	10	57	72	24	.315
MG TF 1250	5	45	45	5	.327
Factory option; ¾ Race with improved low end characteristics.	13	39	50	22	NA
Factory option Full Race; more go in 4000 rpm range and higher revs possible; should use 36 and 34 mm valves, 150 lb. springs and 9.3 to 1 compression ratio.	32	58	60	30	NA
Factory option Mark II cam for improved mid-range performance.	11	57	52	24	NA
Iskenderian H.R. 8 Street; no exchange; factory option cam is reground; peaks at 6000; inner springs and tubular pushrods recommended.	15	54	53	16	.355
Iskenderian 0-1-A Track; peaks at 6500, rev limit 7000; pushrod, lifter, spring kit needed; no exchange.	12	49	48	13	.385
Weber Track; noisy, but o.k. for street; meant for acceleration to 6000; good for 6500 with stock springs and lifters.	22	62	66	18	.378
MG TF 1500	5	45	45	5	.327
MGA	16	56	51	21	.357
Factory option; stock on A-55 sedan and others, part #1H.603, more low end torque.	5	45	40	10	.322
Weber Full Race; 15% bhp increase; top end moved to 7000 rpm with spacers.	20	60	55	25	.409
Iskenderian T-55 Track; 30 bhp gain at wheels at 6500 rpm; 7500 rpm limit; pushrod-lifter kit needed, Morris Minor shell lifters can be used.	19	60	54	25	.428

CAR	INTAKE Open BTDC	INTAKE Close ABDC	EXHAUST Open BBDC	EXHAUST Close ATDC	VALVE LIFT
Iskenderian T-3 Street; 20 bhp gain at 6000 rpm on chassis dyno; 6400 rpm limit; use special inner springs, stock outer; recommend tubular pushrods.	18	59	59	18	.428
MGA Twin Cam	20	50	50	20	.375
MORGAN Plus 4	15	55	55	15	.376
PORSCHE 1500 Normal	2½	37½	37½	2½	.320
1500 Super	19	54	54	19	.360
1600 Normal	5	43	43	5	.325
1600 Super	15	50	50	15	.360
Carrera	38	78	78	38	.315
Iskenderian 2-J; for 2-piece crankcase (1954 and earlier) and radiused followers; special inner springs required.	18	55	53	20	.335
Iskenderian 107 Street; for 3-piece case (1955 and later); mushroom tappets 1500 or 1600 cc; Compatible stock lifters and springs.	35	70	70	35	.365
Iskenderian 108; hotter than 107; 10 bhp gain at wheels; noisy; idles at 600; special inner springs needed.	40	76	76	40	.400
Weber Competition; noticeable rough idle; adds top rpm, 7000 with ported heads; for 2-piece cases; valve shims needed.	19	54	54	19	.327
TRIUMPH TR	15	55	55	15	.376
Iskenderian TR-23 ¾, Street; tubular pushrods required; stock springs o.k.; gain 20 bhp at 6000; idles slightly faster than stock, slight lope.	18	58	58	18	.425
Iskenderian TR-234 Track; quick lift; pushrods required; stock springs o.k.; gain 25 bhp at 6000 rpm.	23	64	64	23	.425
Crower Full Race; 7000 rpm limit; variable rate, generated contour; compatible with stock components.	30	60	60	30	.445
Crower roller tappet; high lift; special tappets needed.	25	65	65	25	.455
Weber Road Race; not too noisy; 6500 limit with spacers.	23	57	57	23	.456
VOLKSWAGEN	2½	37½	37½	2½	.320
Weber full race; developed for use with stroker kit, but satisfactory with stock displacement; revs to 6500 with stock components.	20	57	50	15	.325

in the boondocks is less and less likely to come up with a grind that will stand the world on edge. And, if the average buyer is made aware of the fact that there is more to a cam than lumps on a steel billet, he is less apt to have a garage floor with wall-to-wall engine pieces.

UNDERSTANDING CAM RATINGS

Armed with the thin skim of knowledge we have picked up so far, let us consider sports car camshafts. The accompanying table lists opening and closing times for intake and exhaust valves for a number of popular automobiles in this category. The timing is expressed in degrees of *crankshaft* travel. If it were related to *camshaft* travel the values would be one-half as great, since the camshaft is geared to make one revolution while the crank turns twice. The lift in thousandths of an inch is as recorded at the valve head. Actual camshaft eccentricity is generally less because most rocker arms are designed to increase lift by pivoting around an offset axis. Overhead cams, usually operating directly above the valves, are an exception.

These theoretical valve openings and closings are usually cited in assaying the potential of a given camshaft. However, they can be most deceiving – unless the pattern of the lift is known. The "paper" duration can be as wild as a march hare while the cam itself has an action as smooth as mother's milk. Generally, though, one can compare cams from similar engine designs with closely related valve trains degree for degree.

If you haven't studied such a comparison chart before, it might be interesting to calculate the duration and overlap favored by well-known designers. Duration can be figured by adding the two figures given for open and close plus 180°. (The MGA Twin Cam has symmetrical 250° duration, for instance.) Overlap is measured by combining the two adjacent figures: intake close, exhaust open (again, the Twin Cam: 100° overlap).

A multi-sine-wave cam will have a longer opening period by 10° (cam measure) than a constant-eccentricity design but the valve will be off the seat for the same period of time . . . with the same clearance.

WHY OVERLAP?

Any cam is a compromise. The compromise in sports car camshafts is in the desire to have a smooth idle, fair low-rpm torque and some high-speed performance. To what degree the first two considerations take precedence over the latter determines the duration of valve opening and overlap. As has often been pointed out, a complete amateur, knowing only the four-cycle principle in theory, would have the intake valve open at top dead center, close at bottom dead center and the exhaust vice versa. Experience has proven that it is possible to extend these periods drastically with good results. Since the angularity of the crank determines the amount of work performed or the speed of the piston, it is easy to see that the near-top and near-bottom portions of a stroke are relatively inefficient. The first and last part of the rotation gets you practically nowhere as far as piston travel goes and the movement of the gases is correspondingly slow. So, the designer tries to make use of this drab period by inducing something to happen, even with the most conservative workhorse engine.

Let us picture the piston near the bottom of its power impulse 30° before bottom dead center. Some 93 percent of the usable expansion of gases that produces the power has taken place. If the exhaust valve now begins to make its move, not a great deal of push will be sacrificed. It will take all of that 30° to get the valve moving effectively anyway. Meanwhile latent gas expansion will start a rush out of the exhaust opening and the piston, as it comes up on the exhaust stroke, will meet less resistance.

The middle 90° of piston travel are highly effective and here the bucket attains its greatest velocity. Burned gases are set traveling at a goodly rate and inertia can be counted on to help keep them moving in the direction they are headed. It is therefore safe to open the intake valve to a certain extent before the exhaust valve is fully seated.

Holding the intake valve open past bottom dead center is analogous to closing the exhaust valve late and is done to take advantage of the momentum of the incoming mixture.

Radical timing – more dwell, greater overlap – gain in effectiveness as engine speed increases but reduce the engine's power at low rpm due to exhaust dilution of the fuel/air mixture. Here is a specific area of compromise. It is possible to move the power curve up the rpm scale with any engine (to the limits of its head and valve train design) by altering the valve timing. What use the engine will be put to dictates the shape and placement of the horsepower/torque curves.

COMPATIBLE LIFTERS AND SPRINGS

To avoid loss of low-rpm output, so necessary for the "street" machine, and yet to have some *Sturm und Drang* in reserve, it would be nice to cut down on that long timing and jump those valves up smartly, hold them open for a goodly period of time, close them quickly and get on with it. But the terrible acceleration rates necessary and the physical behavior of the valve train caught between thrust and extreme spring pressure play hob with cam and lifter contact points. Even with variable-acceleration flanks, galled lobes and tappets are a serious problem. As modest a performer as the 1954 Ford V8 caused so many service headaches and customer complaints that Ford revised its tappet manufacturing process in the middle of the model year.

Heat-treated lifters are deemed sufficiently resistant by most factories but chilled iron tappets have been resorted to by independent cam grinders for their all-out models. Chilling of a mold during the pour results in a surface alloy containing a high percentage of carbon in solution which is considerably tougher than the core. If a cam vendor recommends that such special lifters be employed with his product, it is best to comply. After all, he knows the characteristics of the lobes better than anybody.

Designing of springs is a separate but integral part of the cam builder's art. The pressure a spring will exert is in direct proportion to its dimensions. Coil diameter and length usually remain unaltered because of installation problems but higher-performance substitute springs are twisted from more substantial stock. A small increase in wire size will reflect quite a gain in compression resistance. Stiffness is a function of the fourth power of the wire diameter, other conditions being static. So the term "heavier" valve springs is actually correct.

The behavior of a spring, when observed in stroboscopic light, is not at all what the layman would expect. Far from being smooth or compressing and expanding in a regular sequence, a typical valve spring vibrates and contorts according to resonance frequencies and forces set up by the cam lobe. The valve and lifter react by chattering or bouncing.

By using dual springs with differing harmonics, resonances are counteracted and the action is smoothed out.

THE RADICAL METHODS

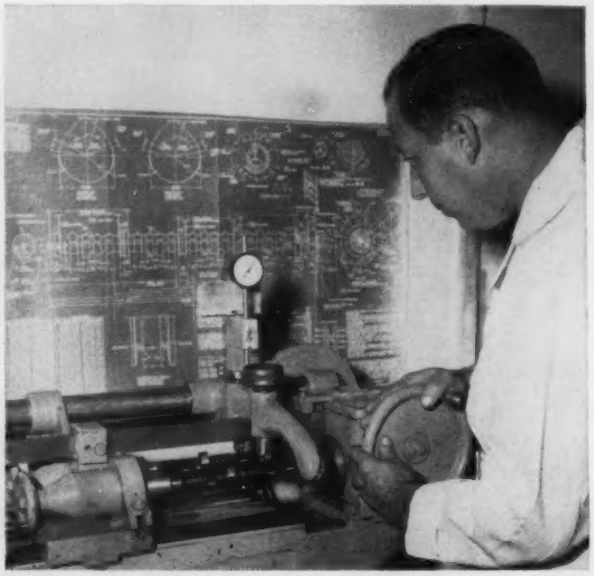
A regrind is not apt to have such drastic timing as a billet cam, on which the designer's imagination is not restricted by existing lobes. Billet cams are used exclusively in building up super-powerful stock-block-based engines for drag racing, straightaway record runs and in some awful-awful sports car specials. In this region we also find the roller-tappet models whose patterns provide an interesting contrast with flat or mushroom-follower camshafts.

Roller tappets have the advantage of not offering thrust resistance. Increased acceleration rates can also be employed without regard to lifter wear. Disadvantages include high initial cost and an increased possibility of mechanical failure at bearing or yoke. But some grinders will guarantee that

you will see 8000 rpm on your Corvette's tachometer with one of their roller jobs.

Required valve lift depends on the port area, valve area and the design of the valve head. Ordinarily it is necessary to raise the valve to a distance equal to 30 percent of the port diameter in order to create an opening of equal area. Most factory-option cams are referred to as "high lift". Increased lift is necessary in the modified engine since ports are usually enlarged or cleaned up to permit better flow characteristics.

Desmodromic gear, wherein the valve is both opened and closed by direct cam action, has been in the news recently because of its use in the Reventlow Scarab Formula 1 cars. The return cam eliminates the need for high spring pressures



Camshaft lobe contours are checked with a dial indicator on special rig. Blueprint of lobes on wall serves as guide for this finickerty process.

and is an absolute preventer of valve float. By containing the valve stem between two eccentrics, acceleration can be increased to what would otherwise be phenomenal rates and the "instantaneous" opening can be more nearly approached. The practical effect is, of course, to broaden the high torque/horsepower spectrum. A case of having your cake and eating it too.

Against the system are the necessity for meticulous machine work within close tolerances, lubrication problems and galling from harmonic vibrations. The Scarabs suffered much loss of testing and development time while just such a scoring problem was licked.

FACTORY VS. SPECIALIST CAMS

Is there an advantage in the privately-offered camshaft over the factory option? For the street, *comme ci, comme ca* . . . depending on your driving habits. For racing, yes.

If you tow or trailer your car to the track you have no worries about idling. If it has enough low-end torque to get you off the grid before the guy behind you can lay a strip of rubber up the back of your Pirelli union suit, you can keep the revs up in the new power range by astute use of the shift lever. For increased performance from an engine whose manufacturer offers no alternate cam, the private grinder is the only answer.

Most firms specializing in this work will do something for you if you simply express your needs or desires. Given the details on engine capacity, carburetion, car weight, axle ratio and conditions of servitude, experts can recommend the proper stick. If you can't make up your mind from advertising literature or hearsay, throw yourself on the mercy of some reputable house.

Is a regrind worth the investment? In certain instances, overwhelmingly. In others you will pay a big price for a small increase in power. The more you have in the stock cam, the less improvement you will purchase. The Duntov cam as fitted to Corvettes is a good example. Most of the leading road-racing Corvettes on the West Coast have tried proprietary cams only to return to the Duntov. What may be good for the quarter-mile is not necessarily good for the twisty track.

It is difficult to measure the gain induced by a substitute shaft unless the engine is dynamometer tested before and after installation with identical accessories. This is seldom done because the cam is generally part of a package which includes porting, an altered induction and exhaust system, richer carburetion and altered distributor advance curve. (At least these options should be exercised to protect the cam investment.) So, it is common practice to utilize the testimonial approach in advertising. "Joe Flank turns 9 seconds flat and 184.567 in the quarter-mile." Or, "Monroe Beetle wins 13 first-place trophies in 12 starts in tough sports car competition," claiming all for the camshaft.

Most grinders have experimented with their sports car grinds under actual conditions rather than on the dyno. They got into the field at the behest of a friend or a good customer, usually, and the cut-and-try method was the handiest. Reports back from the front were quick and direct. One specialist not only got his shaft back after a dissatisfied customer encountered problems, the whole engine was delivered to his shop by a freight line along with a note suggesting that he find out why the valves were firmly embedded in the pistons.

WHAT'S AVAILABLE?

The most popular re-grinds in the sports and imported car segment are for Volkswagen, MG, Sprite, Healey and TR. Weber Cams, for example, runs VW shafts in hundred lots through their machine shop. Sprites and MGs are turned out 50 or so at a crack. Iskenderian places more emphasis on Porsche and he is the only independent who makes much out of merchandising this item, which is bucking pretty tough competition from Stuttgart. The Porsche Super cam fills the bill handily, as most owners will testify, yet Isky's 108 is found in a lot of quick ones.

To give a general idea of what is available in the way of moderate and full-race sticks, the accompanying table lists a few possibilities. All of these grinds are being run very successfully on the street and on the track, hundreds of each have been sold and the manufacturers report no problems. There are more radical models available but with them you are expected to build a rather radical engine hardly suited to commuting. In fact the maker's warranty on one of these shafts specifies that it must not be used for slow speed driving or even driven to and from the track, also that the engine must be disassembled after every few races.

Low-end torque, vital to acceleration trials, is available in some grinds. The mid-range, used so much in track racing, comes with another contour. All-out top-end power, available in big hunks if you plan to maintain nothing but a hot race car, requires still another choice. A sampling in the table will give you a general idea of some cam grind characteristics.

In the end, having spent from $60 to $160 for a new stick and its accompanying components, how do we justify the outlay to the little woman (who probably isn't speaking, anyway)?

Why, just quote her these stirring lines by the immortal poet and lover, Lord Byron:

> "There is nothing gives a man such spirits,
> Leavening his blood as cayenne doth a curry,
> As going at full speed . . ."

—OCR

The gentlemen two up on a Lotus at the right — Stirling Moss and mechanic Alf Francis — enjoy a joint victory lap after a convincing display of car driving and tuning on the Watkins Glen Grand Prix circuit.

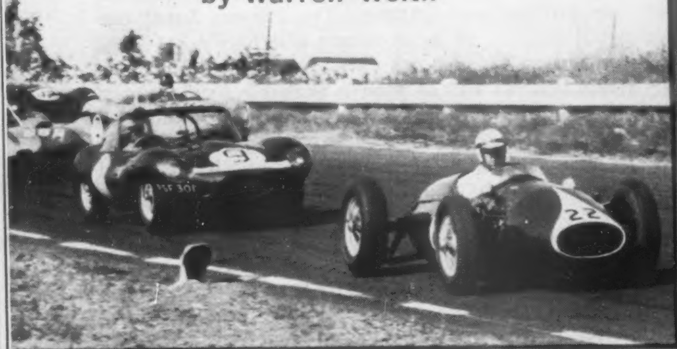
WATKINS GLEN FORMULA LIBRE
OCTOBER 9, 1960, WATKINS GLEN, NEW YORK
100 laps, 2.3 miles per lap

1	Moss	Lotus-Climax	2:10:2.2 105.8 mph
2	Brabham	Cooper-Climax	2:10:10
3	Salvadori	Cooper Monaco	9 laps behind
4	Bonnier	Cooper-Climax	10 laps behind
5	Bradley	Porsche RS-60	11 laps behind
6	Plaisted	Cooper-Climax F.2	12 laps behind
7	O'Shea	D Jaguar	13 laps behind

Fastest Lap
Moss, Lotus-Climax 1:16
Brabham, Cooper-Climax 1:16

WATKINS GLEN FORMULA LIBRE GRAND PRIX

by Warren Weith



PHOTOGRAPHY: DOLIN

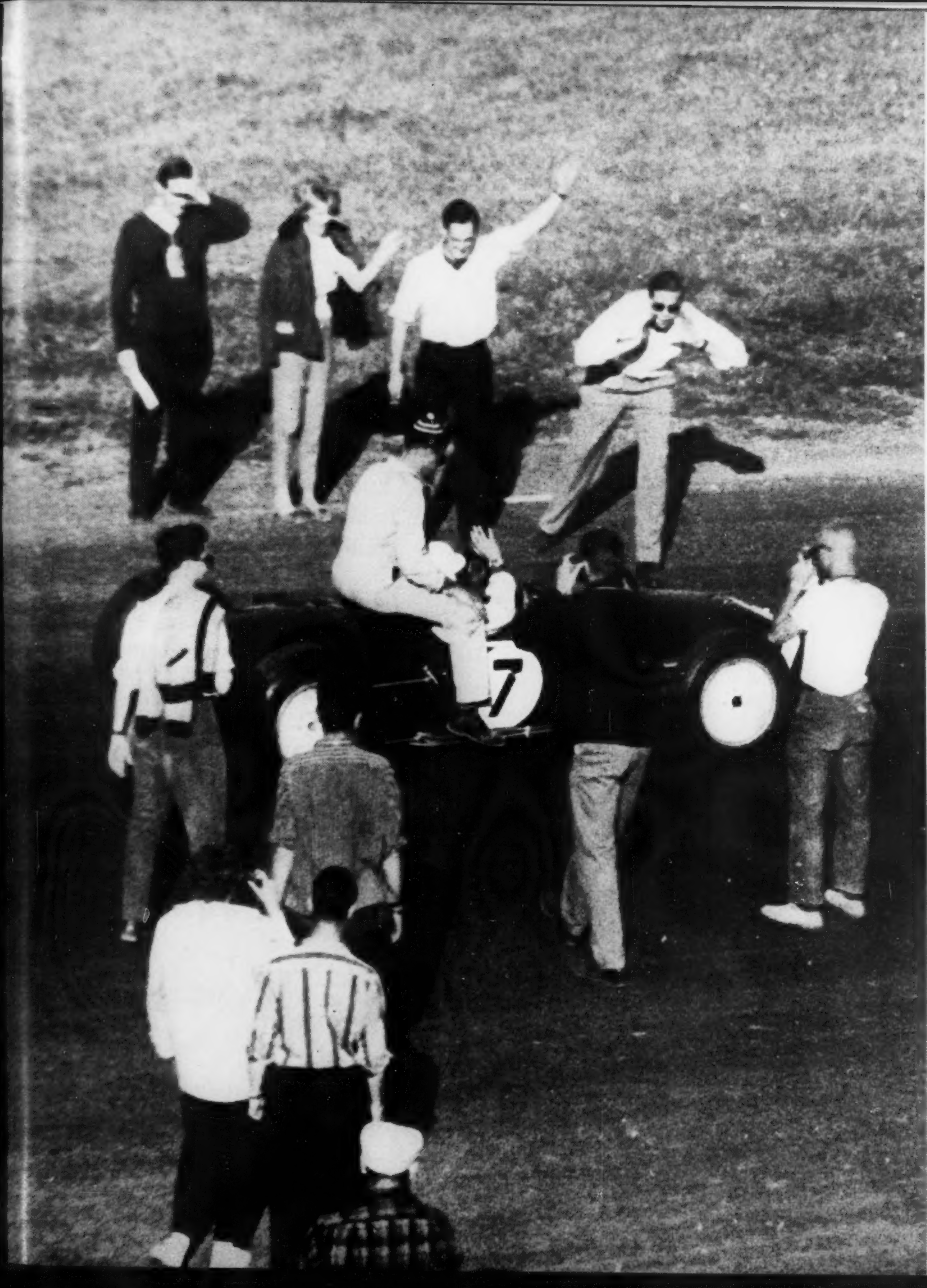
First race for an interesting new Sadler. Peter Ryan in the latest rear-engine car leads a D Jag and an older front-engine Sadler sports-racer.

► Stirling Moss, Jack Brabham, Joakim Bonnier and Olivier Gendebien showed a crowd of about 10,000 enthusiastic Americans and Canadians what modern Formula 1 cars looked and sounded like as they quicksilvered through a full 100-lap F.I.A.-sanctioned G.P. race on the beautiful Watkins Glen circuit.

The entire weekend was one of increasing tension and expectation, reaching a peak at two p.m. on Sunday when starter Tex Hopkins dropped the flag releasing the Rob Walker-owned Lotus, the two Yeoman Credit Coopers, and the Cooper factory car with World Champion Jack Brabham driving. The 13 other cars that made up the field were an interesting collection that ran the gamut from the 1957 Formula 1 Connaught of Peter Murdoch down through the Ecurie Ecosse Cooper Monaco in charge of Roy Salvadori and his stablemate Paul O'Shea in a D-Jag, to two Formula 2 Coopers, two be-finned Lotus sports-racing cars, and a completely new Chevrolet-powered rear-engined car confected by Canadian Bill Sadler in three weeks' time expressly for the Glen G.P.

About 8:30 on Saturday morning the Spartan motor-racing types camping near the paddock felt the canvas walls of their tents begin to quiver as the Climax engines awoke under the ministrations of sleepy-eyed racing mechanics. One of the first cars out for practice lappery, however, was the Auto Union-like Sadler-Chevrolet, with young Peter Ryan conducting. The unexpectedly pleasant handling qualities of this interesting and hitherto untried car soon had Ryan smiling enroute. His smile soon faded as the water pump stopped pumping, forcing the car back into the pits. Next away was a surprisingly fit-looking Stirling Moss attired in an uncreased light blue Dunlop jumper that provided a pleasing contrast to the dark-blue paint job of his Walker Racing Team Lotus-Climax. After checking his own tire pressures with a gauge about the size of Big Ben, Stirling blipped his way down the pit lane, got a wave from the man guarding the exit and screamed away up the hill. For many of those present it was the first sight of a modern Grand Prix car in the hands of an acknowledged master of the art. What was it like? At around 1'19" (the old record was 1'21" set by Bonnier in 1958) the difference between the Lotus G.P. machine and a sports car was about the same as that between a good sports-racing car (such as a Porsche RSK) and a production sedan right off the dealer's floor.

After a number of laps in the 1'20" to 1'19" range it was apparent even to an untrained ear that Moss's Climax developed a frog in its throat at certain points on the course. There followed a series of stops for carburetor jet switching by Moss's imperturbable mechanic, Alf Francis. While this was going on, Jack Brabham — looking tired after a 700-mile straight-through haul from Indianapolis (see page 71) — went out to explore the Glen circuit. If Moss was fast and smooth our Jack was faster (1'18"), but not as smooth, with little mushrooms of dust appearing (*Continued on page 82*)


7

QUICK IN THE QUARTER

by Roger Huntington

The search for split seconds at Detroit's Dragway developed into a struggle between contestants and the rules laid down by NHRA, inspiring solutions ranging from the wild to the wonderful.

► The National Hot Rod Association's annual National Championship drags at Detroit attract the quickest gas-burning machines in the country. competing in various classes in standing-start acceleration over the quarter-mile distance. In color, noise, speed and tension this display rivals the top auto competition events of the world. Every enthusiast should try to take in the "Nationals" sometime.

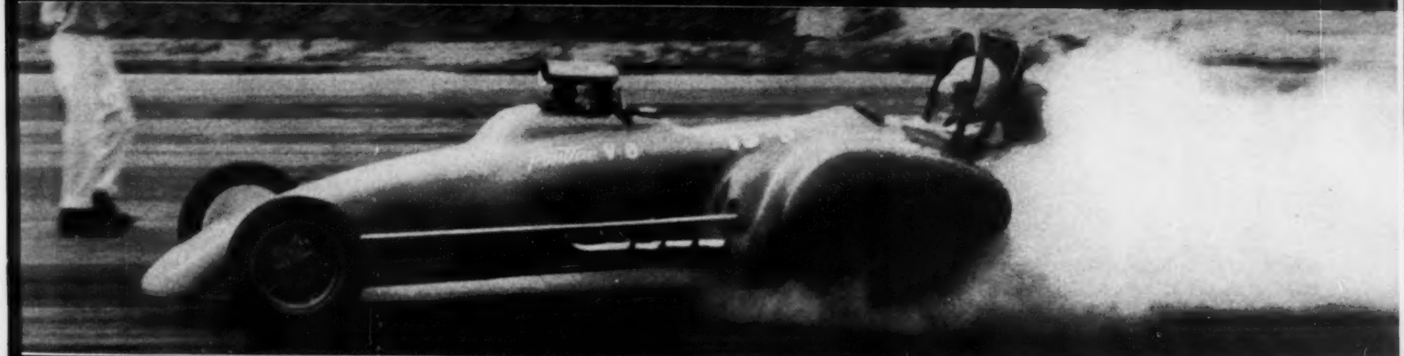
We saw plenty of action this year. Leonard Harris, driving the Albertson blown Olds-powered dragster from Playa Del Rey, California, turned the best elapsed time of the meet at 9.25 seconds—and won a 1960 Ford station wagon by eliminating everybody else in the field in match races. His terminal speeds through the finish-line traps were consistently in the 163-165 mph range on his elimination runs. Dode Martin of Fallbrook, California, driving the twin-Chevy-engine Dragmaster, turned the highest speed of the meet at 171.10 mph —just missing Art Arfons's record of 172 mph with his old Allison-engined dragster.

A list of the outstanding performances this year would just about fill a book. There was Chuck Eichlin of Farmingdale, New Jersey who hit 121.8 mph with a dragster powered by a hopped-up '52 GMC 6-cylinder truck engine. Otis Smith

(Continued overleaf)

Next step to power for dragsters: ram tuning. Carbs are mounted on large plenum chambers, with tuned length of intakes starting from bottom of box. Anywhere from two to eight pots are used in search of free power boost from proper-length intake and exhaust.

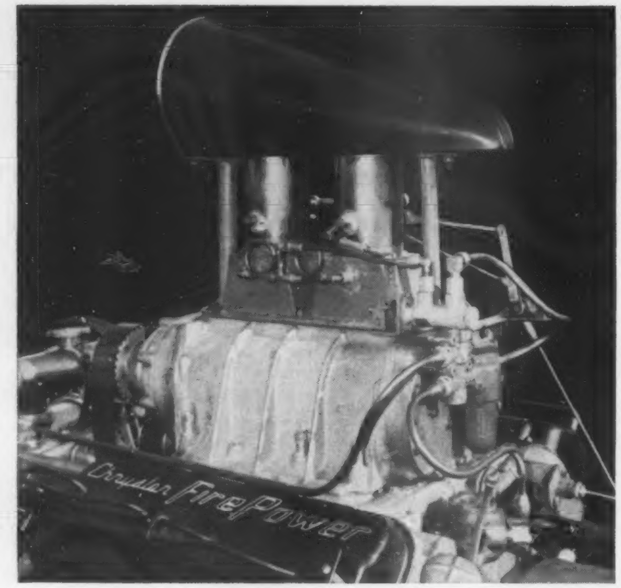
Winner of the Gas Coupe Division was '33 Willys in background. It used a blown Cad for an e.t. of 11.53. Simca in foreground ran a 445-cubic-inch Olds.



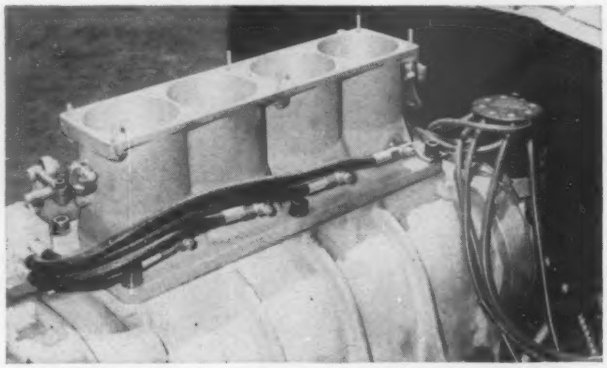
Jim Nelson tries to make Mickey Thompson's sleek Assault live up to its world record reputation. Mechanical failure kept car out of the eliminations.

Devin-bodied car goes against Chevrolet-powered MG TD in B Modified Sports Car class. Class A was won by MG TD with blown 340-cubic-inch Chev!

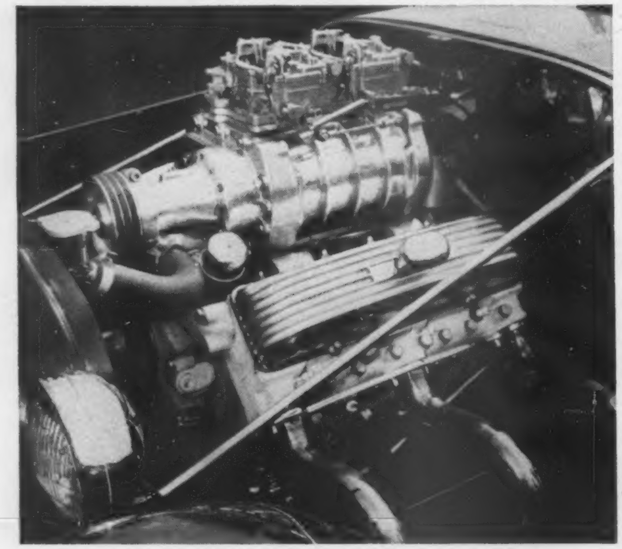
PHOTOGRAPHY: CHANDLER



Fuel injection system by Dave Harding utilized surplus pumps and metering valves. It helps to inject 600 bhp into 444-cubic-inch Chrysler mill.



New Hilborn four-barrel injectors for use with blown engines give greater throat area, and 25 more bhp. One drawback: poor response at low speed.



Sam Parriott's '53 Kurtis sports car is powered by this modest little rig. It is a 450-bhp 396-cubic-inch blown (at 10 psi) Cadillac engine.

of Akron turned 151.5 mph with a semi-competition Ford T-bodied roadster powered by a blown Chrysler. Pete Lickliter of Staunton, Virginia turned an e.t. of 10.35 and 152 mph in an Austin-bodied competition coupe with a blown Cadillac engine. Don Breithaupt of Grand Prairie, Texas hit 128 mph in a 2300-pound '32 Ford coupe powered by a small 265-cubic inch blown Chev engine. Competition was wild in the "Gas Coupe/Sedan" division, for full-bodied cars with full upholstery and street equipment. George Montgomery of Dayton, Ohio hit 131.6 mph and 11.53 e.t. in his '33 Willys coupe with the big blown Caddy engine – and this with more than 300 pounds of ballast in the back! Doug Cook of Los Angeles turned 120.5 mph and 11.78 with a blown 317-cubic inch 560-bhp Chevy engine in a '40 Willys coupe ballasted to 3400 pounds! W. R. Sanders of Paducah, Kentucky went 120 mph with a similar car without ballast – and with an *unblown* Chev engine. Sports cars? Nobody expected Jack Horsley's records set last year with the unblown Lincoln-powered Devin to stand long, what with the new trend to superchargers in all classes. Actually Howard Weaver's Class A-winning e.t. of 12.29 – set in an MG TD with blown 340-cubic inch Chev engine –was over Horsley's time of 12.11 last year, but his speed was 130 mph to Horsley's 122. And Weaver has turned 135 in this car. Horsepower isn't the whole answer; it takes traction, too.

HOW DO THEY DO IT?

In the first place, the performance of any car over the short 1320-foot distance from a standing start depends heavily on only three basic factors: (1) horsepower, and the accompanying *use* of the available bhp by proper gearing; (2) weight, and (3) traction – or, more specifically, tractive thrust in relation to car weight. Wind and rolling resistance, vital factors in any top-speed competition and even in road racing, don't seem to be too important in drag racing. And another modifying factor: most of the modified class divisions are based on car weight per cubic inch of piston displacement. This puts a premium on getting a high bhp output per cubic inch and tends to stifle developments aimed at reducing car weight, since many of the boys have to add a little ballast to make their class. It *shouldn't* be this way, actually. For best traction they should do all they can to save weight toward the front of the car, and then add that much more ballast at the rear – to get a better front-rear weight distribution. But you don't see too much of this.

GETTING HORSEPOWER

Supercharging has been the big horsepower gimmick in the hot rod field for the last two years. It took a ridiculously long time for it to catch on, but it's the talk of the sport today. Most of the winners in classes where blowers are permitted were supercharged this year. This is to be expected, since NHRA rules move blown engines up one class, and the pounds per cubic inch spread between classes averages only about 20 per cent – so the blowers are not handicapped as much as they usually are. (In Gas Coupe/Sedan the blown and unblown cars are separated.)

Practically all the fellows use GMC Roots-type positive-displacement blowers designed for commercial diesel engines. These are suitably modified with increased clearances, beefed-up bearings and end plates, and mounted either on top of the engine on a special manifold – driven by belt or chain – or on the nose of the engine and driven direct from the crank. About three out of four use the top-mounted installation because it's lighter and imposes no restriction loss in the long tubes from blower to ports. A Gilmer cog timing belt is usually used to drive the blower. The drive ratio varies from 0.7 to about 1.3 times crank speed, depending on the size of engine and blower and the desired boost pressure. Most use the big model 6-71 GMC blower because it's cheaper and more plentiful; this has a theoretical displacement of 420 cubic inches per revolution, and can

(*Continued on page 93*)

▶ A little over three years ago, SCI said Indianapolis was a six-letter word spelled torque. It still is. However, a few variations have been added. The visit of Jack Brabham and John Cooper to the famed 2½-mile speed path in mid-October hasn't changed the fundamental theory of how to get around the place. But Brabham's lap in a 2½-liter Cooper Formula 1 car at 144.8 mph has demonstrated there can certainly be a different approach to circling the oval.

The Brabham-Cooper entourage arrived at Indy strictly on an experimental see-what-happens basis. If the results had been as faltering as other European invasions', nobody would have been the least surprised. And nobody would have felt a loss of face. Just the opposite was true; everyone was surprised and the visitors won much admiration. All credit to a talented driver-builder duo.

The Australian chauffeur was obliged to go through the same routine as any other driver who comes to the track for the first time: namely, a driver's test. The United States Auto Club did grant one special favor, however, and this was the bringing out of a full crew of officials, timers and observers to watch just one man run. Probably USAC didn't have to coax the volunteer help very hard, as all were anxious to see a modern Formula 1 car skimming over the brick and asphalt surface.

Cooper arrived a day ahead of both Brabham and the automobile. The owner-builder poked around the garage area, examined the layout of the plant, and soaked up some of the over-40 years of racing lore in the Speedway Museum. The little bomb finally showed up at the unearthly hour of 3 a.m. the following morning. Its debut took place at 9 when Cooper made a few warmup laps in anticipation of Brabham's 10:30 flight into Indianapolis.

The World Champion's first flying lap was at 127 mph. Chief steward Harlan Fengler and USAC's director of competition, Henry Banks, immediately called him off the track and had the unprecedented experience of hearing an across-the-water accent explode, "Crikey, I never realized I was going that fast."

The driver's test at Indy is staged at 115, 120, 125 and 130 mph, with an allowable variation of one mile per hour under and four over these base figures for each section. Brabham traveled mostly about two miles per hour above the base for each phase, giving a nice smooth performance and eliciting the comment from Fengler, "I could tell he was a racing driver before he even got to 125."

At first, the Cooper tended to nose down toward the infield, causing Brabham to end up straddling the white line at the bottom of the turns. But this ceased as the speeds picked up, and it was no longer necessary to correct constantly for wander, as the back end then took a stable "set" for a firm path through each corner. At its fastest, Jack said, it had "a little bit of understeer."

During the 125 mph section, a small rain cloud loomed out of a warm October sky and wet the track with a light sprinkle. Brabham was of a mind to buzz merrily along, a rooster tail of spray flying off his tires, until officials flagged him into the pits and patiently explained that the locals don't consider it cricket to race in the rain.

It is difficult to ascertain just when he felt he was the master of the situation. Following his okay from USAC, he began working into the high 138s, riding with apparent ease and giving the impression he had been driving Indy all of his life. Speedway veteran and 500-Mile-Race-winner Rodger Ward spent much time with the Australian ace explaining the vagaries of the four corners, plus the whys and wherefores of driving a Meyer-Drake-powered roadster

BRABHAM ATTACKS THE BRICKS

by George Moore

The Brabham-Cooper combination (John pushing, Jack buckling helmet) amazed Chief Steward Harlan Fengler and the rest of the Indy regulars by turning a 144.8 mph lap just two days after arriving at the famed brickyard.

around the oval. It was Ward's contention that Brabham would have to follow the same pattern to move along really fast, and this advice turned out pretty much correct.

First he tried shifting gears in the corners, but abandoned this as a waste of time. He quickly fell into the pattern of laying over next to the wall on the front straightaway, swinging down skirting the edges of the white line in the middle of the turn, then drifting back up to the wall on the short chute between corners in order to get set for the next turn. As Brabham worked up over 140 mph, he began developing minor differences from the Meyer-Drake pilots. He started driving deeper into the turns before feathering back on the throttle. And on No. 2 and No. 4 corners he rode much higher on the bank with his right-side wheels flicking the edge of the dust blanket which always lies just outside the groove.

At Indy, some of the earth under the track at No. 2 and No. 4 turns has settled during the past half-century, so there is a slight sloping depression high on the banking. When driving at moderate speeds, this doesn't bother a driver. But when running really hard, he suddenly finds the race track falling away from him, encouraging the back end to come around and setting up the possibility of a spin. For this reason, veteran and rookie drivers alike tend to swing into the white line early and hook the car around these two corners.

Brabham completely broke all the rules here, roaring right across the deepest part of the depression, the falling surface seeming to have no ill effects whatsoever. The light weight of the car's independent suspension plus the traction of the soft Dunlops maintained stability and countered any bad effects of being airborne.

Just six hours after he first walked through the gate, the gentleman from Australia earned the title of racing driver *par excellence* by Indiana standards. USAC timer C. B. Smith caught him on the electric eye with three identical laps at 142.857 mph (63.00 seconds). Then he banged out the one at 143.403 mph (62.76 seconds) for a four-lap average which would have qualified him in any previous Indy 500.

The next day was even better. Cooper called a halt to proceedings to enable mechanic Mike Groman to make a gear change for more rpm, and change jets in the Webers to get more gas through the intake ports. Brabham spent most of the morning clocking about the same speeds as the previous afternoon. After giving it the old school try, and not gaining anything appreciable, he pulled in and told Cooper he wanted to change the roll center. This operation is equivalent to what the Americans call "jacking the weight." By taking more weight transfer at the front, he ensured a better, more even bite at the rear wheels.

If traction is what he wanted, traction is what he got. He took off from the pit apron peeling rubber and turned the first lap from a standing start at 125 mph. Getting down to business, he turned three laps at 143.323 (62.795 seconds), one lap at 144.695 (62.20 seconds), than cranked on a sizzler at 144.834 (62.14 seconds), causing the Speedway fraternity to jump right off the pit wall in sheer excitement. No wonder, that's only 5 mph or two seconds off Hurtubise's fantastic 1960 lap record.

In the cold light of facts and figures, Brabham's performance will not start any mass exodus away from the Meyer-Drake, at least not yet. He had a lot of things going for him. He was alone on the track, so could take a healthy run at the corners. His time through the ¼-mile traps in turn No. 1 was 6.45 seconds or 139.5 mph, just a tick away from Eddie Sachs's all-time record of 6.43. But his fastest time from the No. 4 corner to the starting line was 11.21, a full two seconds slower than a Meyer-Drake over the same distance. And he was maintaining his average by never letting his rpm vary more than from 6700 on the chutes to 6000 on the turns. In the race, where he inevitably would be trapped in traffic occasionally, the lack of torque from 100 too few cubic inches would be a serious handicap.

The Dunlop road-racing tires were getting a terrific grip on the asphalt turns, so great that the right front was completely gone in 10 to 14 laps. Brabham absolutely will have to have a harder compound which can carry him 30 to 40 laps before a pit stop becomes necessary, and this most certainly will affect handling. On the other hand, a harder, "Speedway" tread would offer less rolling resistance, giving the Cooper a chance to better its speed down the straights. With the Cooper's light weight, some think it could go all the way on one set of Firestones — except Cooper *has* to use Dunlops. John Gullery, American representative for Dunlop, was present and taking a myriad of readings, so perhaps he will have an answer to this problem.

On the plus side, the Cooper does not need a five-speed gearbox, so weight can be saved here although it's offset to a degree by the necessary adoption of knock-off hubs. Also, the English builder said if he does build a car for the Speedway he will expand the engine to 2.7 liters and go to fuel injection in order to burn alcohol. The "alky" alone is expected to give him about 15 percent more power.

Whether they come back or not, and current odds-on bets are that they will, the Cooper-Brabham performance has left its mark on Indy. Those who were present witnessed the birth of what eventually may amount to a new era there, and it is hoped this will result in what almost everyone has long wanted — actual competition from European cars and drivers in the annual 500-Mile Race. —*G.M.*

Editor's Note: An oft-forgotten Indy rule of long-standing requires at least 96 inches of wheelbase. The Cooper has only 91 inches and there will be a lot of head scratching before John Cooper lengthens it or USAC amends its rule. The latter originally was established to keep out sprint cars which had gotten very fast but were neither stable nor reliable. The organizers wanted to have a full field of Championship cars, all of which were more or less capable of going the full 500 miles.

The Cooper is a small dot on the vast expanse of the empty Speedway as World Champion Jack Brabham sets it up for one of the four fast turns.

TECHNOTES

PISTON SPEED AND HOW TO CORRECT IT

What is meant by "Piston Speed $\div \sqrt{s/b}$"? In your Road Research Reports you also use the phrase "Piston Speed, 'corrected,'" which seems to be the same thing.

F. L. Nieva
Miami, Florida

The actual speed of a piston varies approximately sinusoidally from zero at the top and bottom of the piston's stroke to a maximum when about half-way between. "Piston Speed" as an enthusiast's term is the arithmetic average, obtained simply by multiplying twice the stroke by the revolutions per minute. Since feet per minute are handy units, this can be recast as the stroke in inches multiplied by one-sixth the rpm.

For many, many years piston speed has been used as a parameter of engine wear, a general rule of thumb being that any car could be cruised indefinitely at whatever mph gave 2500 feet per minute piston speed without undue wear and tear. The logic behind this actually has nothing to do with the rubbing velocity of the piston and its rings against the cylinder walls. Let's look into it briefly.

Let's start with the optimistic assumption of engineers the world over, "all other things being equal." If they are, in two engines different in displacement but geometrically similar (identical number of cylinders, stroke/bore ratios, etc.), stresses in the large engine (L) will equal those in the small engine (S) when their speeds are related in the following manner:

$$\frac{S_L \times rpm_L^2 \times B_L^3}{B_L^2} = \frac{S_s \times rpm_s^2 \times B_s^3}{B_s^2}$$

You may derive this for yourself, keeping in mind that loads are proportional to the stroke, the square of the rpm (the peak acceleration) and the cube of the bore (the mass of the piston). Stresses are proportional to all of these but inversely so to the square of the bore (since the bearing area or connecting rod cross-section will be proportional to the piston area). If we stick to our claim that all other things are equal, the equation simplifies to the statement that the piston speeds of the two engines are equal ($rpm_s \times S_s = rpm_L \times S_L$).

*On the other hand, if we admit that the stroke/bore ratios are **not** identical, the equation comes out either this way:*

$$rpm_L \times \sqrt{B_L \times S_L} = rpm_s \times \sqrt{B_s \times S_L}$$

or this:

$$\frac{rpm_L \times S_L}{\sqrt{S_L/B_L}} = \frac{rpm_s \times S_s}{\sqrt{S_s/B_s}}$$

The former is the easier method for calculating this parameter, and the latter gives it its name of "piston speed divided by square root of the stroke/bore ratio," or more simply "corrected piston speed."

*Some people feel that piston **acceleration** ($rpm^2 \times S$) is the operative factor, but this omits the influence of the bore size. Enlarging the bore raises the piston mass faster than it increases the bearing area available, since the former goes up as the cube and the latter as the square of the bore.*

A stricter investigation would include the term $(1+\frac{1}{2n})$ where n is the ratio of connecting rod center-to-center distance to the stroke. This would take care of the fact that the piston's motion is not sinusoidal. However, n is generally equal to about 2 and the term given is not at all sensitive to changes in n.

The Jaguar 3.8 and its 3.4 and 2.4 predecessors make an interesting basis for comparing the use of piston speed and corrected piston speed. Since the 3.4 was the first on the market, it is fair to think of the 2.4 as a de-stroked 3.4 and the 3.8 as a bored-out 3.4.

	2.4	**3.4**	**3.8**
Bore	*3.27*	*3.27*	*3.42 inches*
Stroke	*3.02*	*4.17*	*4.17 inches*
Rpm @ peak power	*5750*	*5500*	*5000*
Piston speed @ above rpm	*2890*	*3820*	*3820 fpm*
"Corrected Piston Speed"	*3010*	*3390*	*3465 fpm*

Using the ordinary piston speed concept, it would appear that the 2.4 could be revved up to 7600 rpm without overstressing it whereas using "corrected piston speed" we get the more realistic figure of 6500 rpm. (Incidentally, the 2.4 was never developed as highly as it could have been for road use.)

As for the 3.8, the conventional piston speed concept makes it appear identical to the 3.4, where in truth we know that the larger piston does increase the loads on the wrist pins, connecting rods, crankshaft and bearings. The small increase in corrected piston speed reflects this.

*When it comes to comparing completely different engines, one is on less firm ground. In our road test and RRR specs, we give corrected piston speed at the rpm of peak horsepower. A low value does not guarantee a lowly-stressed design, but it does indicate this, just as a high value indicates a highly-stressed one. Of course, "corrected piston speed" doesn't take into account how meaty the connecting rods are or what type of bearing metal is used. No parameter can. It does give an idea how sturdy the parts **should** be, a better idea than piston speed alone and, now that we've explained it, we hope it's less misleading a term as well.*

TIRE PRESSURES

The TR-3 manual says 22/24 psi for Dunlops and 24/28 for Michelin X's, front and rear respectively, and to increase by 5 psi for high-speed touring. I have two friends who race TR's extensively but they have different opinions, from each other as well as from the manual. One says the rear tires should have 5 pounds more than the fronts, the other says 2 pounds less.

I'm inclined to agree with the 2-pounds-less theory as the rear end will break loose first instead of the front end mushing out on you. I would be interested in hearing your opinion.

Ralph Dolente
Utica, N. Y.

Fiddling with tire pressures is the easiest way to change a car's handling characteristics (though you can't make a silk purse out of you-know-what). Many drivers do this, even making changes for a particular track on a particular day, but what's best for one driver won't necessarily be so for others. It's difficult to make useful, all around recommendations. As a guidepost, start with the factory's figures for high-speed touring. (Aren't some races just that?) Then adjust from there in increments of about 2 psi till the driver finds a set-up he prefers.

Taste is certainly involved. For example, you prefer the rear tires a bit soft so the front won't mush out. Many drivers (myself included) prefer to have the front end let go first. On the other hand, you seem to have Jack Brabham on your side, among others. Chacun à son gout.

MG-CHEVY

In going through my back copies of your magazine (I keep all of them), I saw something interesting, the Chevy V8 installed in an MG TD. I would like to make a similar switch. (1) Would a four-speed transmission fit as well as the three? (2) How will the rear springs stand up to all that extra torque? Would something like Traction Masters help? (3) Can the MG radiator handle the Chevy's hotter water?

Keith Saxe
DesPlaines, Illinois

In order: (1) Yes, the two manual Chevy gearboxes are physically interchangeable. (2) Not very stiffly — yes, indeed. Some such radius rods would be most advisable, otherwise you will experience extreme axle tramp. Be careful installing them so that they are horizontal when the car is setting on its wheels. If they trail downhill, they will induce roll-oversteer (the more the steeper). (3) Yes and no. It would probably be adequate if all the car's new power is used only for short intervals, say at drag races. If you should indulge in lengthy periods of fast motoring, as in road-racing, you will find the original radiator quite inadequate, except in mid-winter — and who races then?

BLOWOUTS

Assuming high speed in a straight line, which is worse, to have a front tire blow out or a rear one?

Paul H. Huzzard
Warren, Michigan

*The front tire blowout is worse because it can and usually does make the steering nearly impossible to control. Therefore in the summer you **will** want to have your best tires up front, though in the winter you'll want them at the rear for better traction.*

CORRECTION

*The twin-cam Climax engine referred to in November Technotes costs $2800 new, not $1500 as quoted. Furthermore, this is the price at the Coventry factory, shipping and import duty costs would have to be added. If any further discouragement is needed to keep anyone from putting one in a TR-3, we don't know what. As a matter of fact, our idea of what to do with a left-over Climax twin-cam was to install it in a Citroen ID-19, a car that has everything **but** power. Of course, quieting those narrow cam-drive gears would be an interesting challenge if one wanted to hear the clock at any speed.*

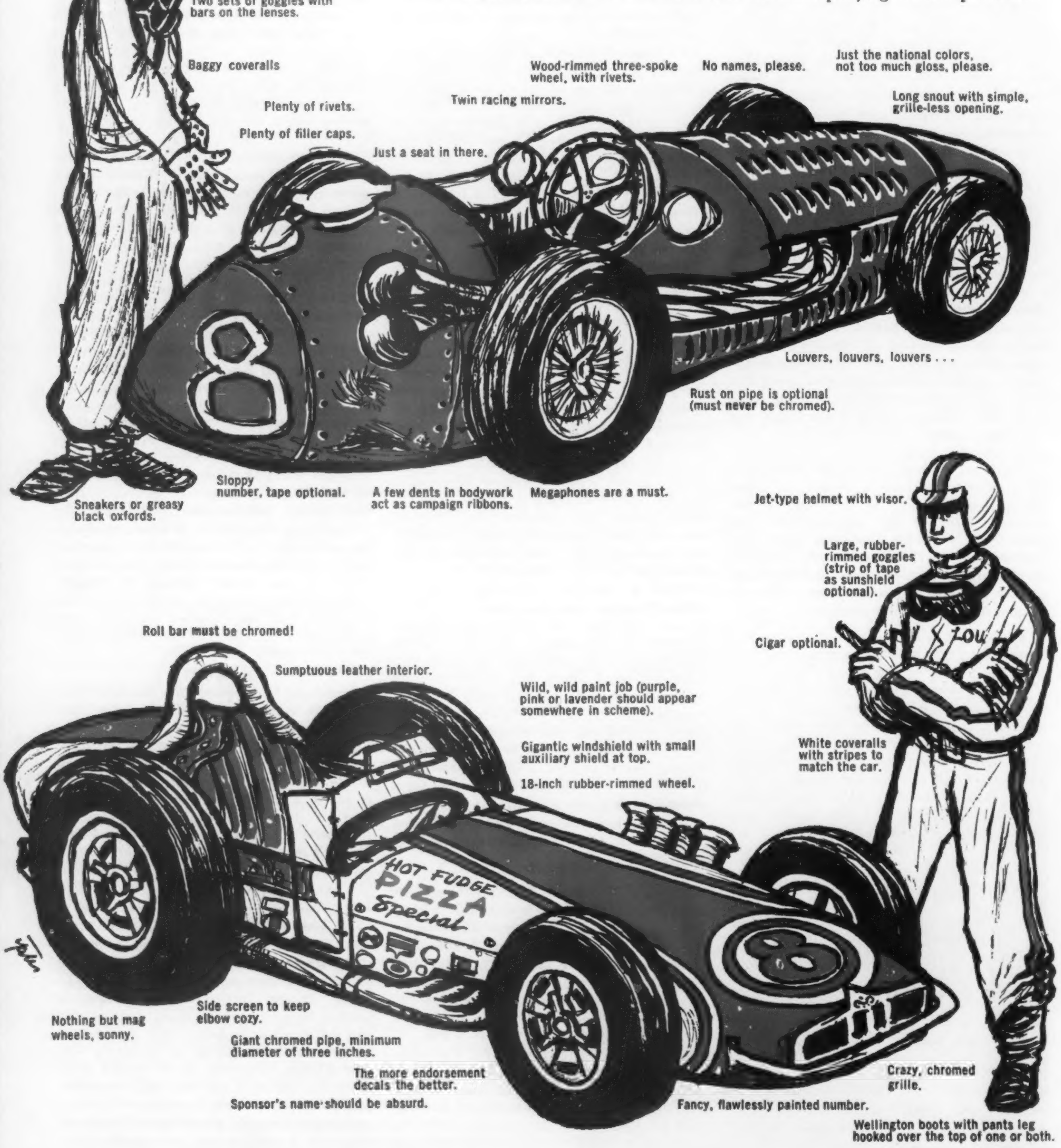
How To Play The Game

by Brock Yates

► There is a set of unwritten rules of style in race car design and race wear both here and abroad that, if ignored, can cause unending grief for the owner and driver alike. These subtle touches can be every bit as important to the prospective entrant as a gutty engine and faultless suspension system.

For example, a car arriving at a European Grand Prix outfitted with a chromed roll bar would spell social disaster for its sponsors. Likewise, a machine attempting to qualify for the Indianapolis 500 with rumpled, rivet-pocked bodywork would be laughed off the course.

To assist future owners and drivers the accompanying chart is provided.



BORGESON AT BONNEVILLE

Continued from page 29

like monsters seemed to communicate with each other or at least to fortify their own spirits through the deafening menace of their own voices.

Ostich maneuvered into position and blasted off. He was using 90 percent of takeoff rpm (about 7200) for the first time on an actual run and for the first time we saw black smoke boil thinly from the big, bug-like car's tail cone. Ostich howled down the salt, storming. Then again he shut off, again the 'chute fluttered out, filled, snapped the car into straight-line hard deceleration.

This time Ostich simply lost his steering. The front wheels were fluttering back and forth; the car was skating. Ostich was fighting the wheel so desperately with both hands that he didn't dare remove one hand for the time required to close throttle and deploy 'chute. Its release lever was located alongside the throttle lever's full-open position. He had no choice but to make one lightning gesture: pop the 'chute and close the throttle in one movement, while risking burning up the 'chute in the heat of his own exhaust. The 'chute did not catch fire and once again it brought the Caduceus back on an even keel, once again it was Doc's salvation.

His steering had failed him and Ostich went home. Some of us thought, "So that's what happens with jets. Crank on the power and it doesn't matter what you do with the front wheels; the thrust just shoves them where *it* wants to go. You need a rudder." Doc does not agree. His steering connections were conventional spring-loaded ball joints and he believes that, at high velocities, the springs began to float. He is rebuilding his steering linkage, using Heim joints and every other means of eliminating backlash. Ostich will go again and, at mid-October presstime, he still had hopes of running before the end of the year.

Art Arfons and his partner Ed Snyder reached the Salt from Akron, Ohio on August 26. Arfons tried the car out on the 27th, the last day of the Nationals. He was asked to keep his speed under 200 mph and did so, with runs in the 190s.

The design of his chassis was clean, efficient and logical; the car was capable of going very fast. Lujie Lesovsky's body paneling was beautiful in its execution but no one rejoiced over the car's front-end treatment, least of all its designer-driver. Arfons had laid out the chassis in the light of years of drag-racing experience but he found that ten seconds over the asphalt quarter-mile is no conditioning for ten miles and more over blinding whiteness; above all when you are sitting right in the nose of the vehicle with a blizzard rushing into your eyes and with only the faintest inkling of what the mass of the machine is doing behind you. After his first ride Arfons decided upon about a dozen basic changes that should be made in his car.

However, he did his best under the

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(*Continued from page 75*)
prevailing conditions and on September 5 made a trial run at 249.57 mph, looking splendidly stable. But he was running lean, wiped out a driveshaft needle bearing (14,000 rpm pinion speed) and his pilot 'chute snapped its 4500-pound tensile strength nylon lead line. Arfons, much wiser, retired. Now, with first-hand knowledge of the salt, he plans to revise his machine. He possesses an excellent blend of courage and caution, is remarkably inventive and resourceful and remains a major figure on the LSR scene.

Along with his fame, Donald Campbell's entourage preceded him. The like had never been seen; it resembled a military invasion. Over 80 people: mechanics, technicians, engineers, communications personnel. Eighty immense tires, each in a six-foot-square wooden crate, filled one end of a large aircraft hangar. There were more Rovers per capita in Wendover than Studes in South Bend. When the natives recovered from the initial shock they remembered that Bluebird was a long way from home and the colossal scale of preparation became comprehensible.

Each of the residents of the temporary Crown Colony of Wendover was an excellent ambassador for Britain. As a group, they were honest about their intentions, realistic about their qualifications, openly frank in their communications. They were the first to emphasize the hearsay basis of many of their calculations, the totally theoretical nature of their conclusions and their poverty of first-hand knowledge of what they were about to attempt. They resented the multi-million-dollar buildup that their project had been given, the emphasis on the ever-expanding inflation of its alleged cost and the general air of feverish press-agentry that kept twin Teletypes pounding whether or not there was news to report.

With such obvious exceptions as Don Badger and Andrew Mustard of Dunlop there were no automotive people on the project; most of the talent was from the aircraft industry, some from the field of naval architecture and marine engineering. One of the handicaps under which Bluebird's designers labored was a complete lack of familiarity with the Salt. When, in England, they would ask engineers who had been there about the smoothness of the salt they got answers such as, "Oh, it's bloody smooth, old boy. Just like a billiard table." So, Bluebird's suspension was based on an assumed worst possible condition of a one inch rise in 300 feet. In actuality, the surface contour can change much more abruptly than that.

The hackneyed label, "laboratory on wheels," had been applied to Bluebird but in this case it was entirely apt. The vehicle was a mass of circuitry by means of which a wealth of data could be telemetered back to elaborate receiving and recording equipment in the pit area. By means of telemetry it would be possible to record every change in lift, yaw, suspension deflection, turbine rpm, gearbox temperature and many, many other critical parameters while these changes were taking place. This would make possible the immediate acquisition of precious knowledge, much of which could be obtained in no other way, including the time-consuming method of tearing down the car. Bluebird also was equipped with two-way radio for communication between driver and pit personnel.

The first major disappointment and one that constituted a genuine loss to engineering knowledge was the discovery that neither the radio nor the telemetry would function on the salt. Bluebird's electronics people had not been aware of the weird electrical effects that are typical of that desert and have been major obstacles to wire, wireless and TV transmission over the area. We immediately referred them to Bell Laboratories, some of whose physicists have made extensive studies of these very phenomena.

Bluebird was a magnificent car, both in conception and execution. Its conquest of the LSR was a foregone conclusion. It was huge and dwarfed the rest of the season's LSR aspirants. Its dimensions had been dictated to a large extent by its 52-inch o.d. tires. In the August 24 issue of THE MOTOR (London) technical editor Joe Lowrey, who has first-hand knowledge of the salt, wrote:

"Donald Campbell's LSR contender has been designed around colossal 700x41-inch tyres, on advice from the 'experts' that nothing smaller could be counted upon to do the job; I would dearly like to know whether, if hard-of-hearing designers had produced a much better streamlined car with room only for 700x31 or 700x21 tyres, the Utah salt would really have been littered with flung treads? My own suspicion, with no prospect of being asked to risk my own neck, is that at the expense of a vast consumption of aspirin and midnight oil at F.rt D.n.l.p, the 'impossible' would have been done."

Of course Norris Brothers, Ltd., designers of the car, had architected it around the rubber that the tire manufacturer was prepared to provide.

Campbell's exclusively reserved time on the salt began on September 12 but, due to the existence of the open week, he moved it up. He joined his group in Wendover the night of the 3rd, examined the salt and witnessed Arfons, Ostich and Thompson in action on the 4th and was ready to make his first run on the 5th.

About one p.m. the mile-long cavalcade proceeded to the salt, Bluebird in the lead on a huge Cummins diesel flat-bed, then several elaborately equipped Land Rovers, then a couple of British Petroleum racing vans, then a couple of dozen Rovers, then a file of U-Drive Chevs. Bluebird was unloaded, her Indy-type automatic jacks extended, fresh tire-wheel assemblies mounted.

The car was made ready and Campbell sat on its nose (you could walk around on the skin of this unit-construction vehicle) and levered himself up and back to the cockpit and entered. He was handed someone else's USAF helmet, which he succeeded in getting on only after three abortive, exasperating attempts.

(Let this be clear: I am not ridiculing a brave and gallant sportsman. I am trying to inform you, who were not on the scene, of what happened; you may not get the facts elsewhere. And I'm leading up to a point.)

Campbell buckled on the lap belt and shoulder harness of very light nylon webbing. There was a long conference between designer Ken Norris, chief mechanic Leo Villa and Campbell, who was checked out on the vehicle's instruments and controls. The canopy was closed, the engine started and Bluebird moved forward for about 200 feet, came to an abrupt stop and the canopy flew up. Everyone was standing, flat-footed. I sprinted up to the cockpit and Campbell shouted, "The crew! Quickly!" His first words to Villa were, "What's this red light mean?"

All eventually was squared away and Campbell resumed his first run. Using a very small, predetermined throttle setting he motored gradually down the salt and cleared the traps at 124 mph. Debarking, he asked Villa to install the lowest steering ratio possible; evidently, even at this speed, those almost-six-foot gyroscopes were difficult to move.

"Is this the fastest you've ever driven, Mr. Campbell?" a BBC reporter from Toronto asked.

"Well, my 300SL *feels* faster," Donald chuckled as he lit his pipe.

Campbell made a 172 mph return run at dusk and Bluebird was trailered back to its hangar at Wendover AFB where the 25:1 steering ratio was altered to 100:1 and where the car was torn down for thorough inspection. The press agents announced his speeds as 150 and 190 mph.

On September 16 Campbell made his fifth run and was cheerful about having reached 300 mph in three miles. A kill-joy reminded him that 300 in the first two miles was the target for the record, which may have influenced the course of events.

Up to this point each run had been made with a fixed throttle setting, with fixed compressor-turbine rpm. The vehicle was permitted to go as fast as that setting would allow and, on clearing the traps, the throttle was closed. Campbell decided to make the sixth run his first acceleration run.

He ran the compressor turbine up to 9500 rpm, which was the starting point for record attempts. He charged away, increasing his throttle opening. And then he crashed. The story given to the press was that the car had gone out of control because of (1) slight cross winds, (2) poor condition of the surface and (3) greater engine output than had been anticipated.

What actually happened closely parallels the Athol Graham tragedy. Graham accelerated so hard that he broke traction for a long distance, yawed off course, got sideways, flipped. *He* landed upside down.

Bluebird's telemetry system had been rendered partially operable and was registering driven-turbine rpm. It indicated that Campbell was doing 360 mph. Tire slippage would exaggerate the true velocity but expert estimates fix it at a conservative 325 and a probable 350. He may actually have been going much less rapidly but the point is that he was indicating this speed in just 1.7 miles (the press agents had to say 365 in 1.6), accelerating much harder than existing traction justified. He got sideways and the resulting overturning couple flipped him. Unlike Graham, Campbell made a complete roll in the air (during which all four wheel spats blew off

(*Continued on page 78*)

SUPERB FULL COLOR 20″ x 29″ MERCEDES-BENZ VICTORY POSTERS

AUTHENTIC—BEAUTIFULLY PRINTED—FULL SIZED—DECORATIVE

THE GRAND PRIX OF BELGIUM 1939

This beautifully reproduced poster represents one of many Mercedes victories on the famous Francorchamps circuit. The stark black of the type and the exciting sketch of the wonderful M 163 car (the incredible V12 which was so successful) against a brilliant orange background create a truly electric effect. This is a masterpiece of graphic art. It lacks but the sound of this great engine to recreate the atmosphere of the race. The sensation of motion in this poster is a remarkable thing.

THE GRAND PRIX OF TRIPOLI

Because it tells a story of great historical significance, this poster of the 1939 Tripoli race is an historical document. As far back as 1937, the F.I.A. had considered changing the International Formula to 1½ litre supercharged. However, they did nothing about it and it did not become effective until after the war. This did not prevent the Italians from developing 1½ litre cars and announcing a scant eight months before the Tripoli Grand Prix that this race would be run under this formula. They hoped thus to steal the limelight from the Germans. Mercedes, undaunted by the lack of time, developed a car (the M 165) and won the race—Lang driving and winning this event for the third time—with little difficulty. This was certainly the crowning achievement of the great racing years 1934-1939. This was the only race this car ever ran in. The poster is a typical product of the Mercedes-Benz art department, brilliant in color, brilliant in design and execution. The bright icy blue of the Sahara sky contrasts vividly with the hot yellow sands, and a fine sketch shows the white M 165 streaking along under the green palms.

THE GRAND PRIX OF MONACO

No one who saw or read about the 1937 Monte Carlo race will ever forget it. von Brauchitsch and Caracciola staged a neck and neck duel which left spectators hoarse and limp. Lap after lap the two cars sped around the twisty course through the streets of the famous Mediterranean resort. Caracciola finally stopped for fuel, giving von Brauchitsch a 40 second lead. Then von Brauchitsch stopped, and in changing a tire, one of his brakes locked on. The mechanics banged on the drum with hammers and kicked the wheel, while von Brauchitsch gunned his engine and fumed in the cockpit. Finally, it came loose and he shot out a mere second ahead of Caracciola, a lead which he maintained until the end. This is a stark poster in brilliant yellow with black and white type and a head-on sketch of the incredible M 125—the 600 horsepower monster.

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Two brilliant colored posters of famous races. An explosively bright and simple poster of the "Monte Carlo of the West", the Grand Prix of Cuba of 1957, and an outstanding British poster for the British Grand Prix of 1958, in which all the information required by a prospective spectator is neatly arranged in varying colors.
P-2 $5.95 The Set

Two fine posters from England; the first announcing an exciting day's racing at Brands Hatch. In startling black, green and yellow. The second announcing the famous Whit-Monday meeting at the BARC's Goodwood Circuit, well known as the hotbed of budding British drivers.
P-3 $5.95 The Set

(*Continued from page 76*)
simultaneously) and landed more or less on his wheels. Bluebird had *no* roll bar. It was assumed that if the car flipped the wheel bumps would prevent the canopy from contacting the surface but the extent of structural damage that inevitably occurs under these conditions makes this a sanguine assumption.

The press-release "causes" of Bluebird's crash were not without some possible small significance. Others can be added. One is the far-forward seating position which was dictated by the machine's engine configuration. Sitting in the nose of a vehicle you have little or no warning of changes in lateral attitude.

Then there is the matter of the lag in response between compressor turbine and propulsion turbine. This obvious phenomenon of delayed response to throttle opening is a grave problem with gas turbine vehicles which have no mechanical connection between their driving and driven rotor assemblies; it results in traction-breaking leaps of acceleration if too much throttle is used. The problem is intensified to the ultimate degree in LSR attempts on the salt, due to the short distance and time available for acceleration. And then there is the subject of gyroscopic forces, a future article in itself.

Campbell simply was in much too big a hurry and is alive solely by the grace of God. Bluebird's engine and many of her components can be used again and Campbell plans to build a new car around them and to return to the salt in '61. Incomparably richer in experience, the team's prospects for success are greater than ever.

Every American who had any contact with the Bluebird effort expected it to succeed and wanted it to, if only because it so clearly merited success. Mickey Thompson was extremely close to all this and felt the genuine regret for Bluebird's ill fortune that he, alone in the whole world, could. There is little satisfaction in victory by default.

Mick was in Wendover when the British arrived. They had no practical experience with the salt or with super-fast motoring. Mick placed himself and his experience at their disposal. This was appreciated and his vast store of unique knowledge was absorbed with care. The cooperation between rivals was not one-sided. Thompson and Campbell had much in common. They respected each other, enjoyed each other's company, needled each other with merciless good humor. Thompson went through absolute hell on the salt this year, and Campbell was not unaware of his problems. When it appeared that Mickey would run out of reserved time before he could accomplish his objective Campbell said, "Mickey, as long as I have time on the salt you are completely welcome to it."

Mick of course was on the salt on August 1 to observe the efforts of another rival. At nine a.m. he came up to me at the USAC timing stand and said, "I've just gotten the 'phone pole removed at the south end of the course. I'd like to tell Athol about that and anything else I can that might be helpful. Do you think that the Firestone guys would resent my presence?"

"Of course not," I said, and we went to Graham's pit at the north end. This was a nice, thoughtful and not an easy thing that Mick had done on his own initiative. Competition is his life's blood and I know of many times that he has gone out of his way to help rivals. He did his best to help Graham.

When the crash occurred Mick was among the first to reach the wreckage, to do what he could to help and to analyze the situation professionally. It was a bad way to begin the season. You can be sure that Mickey identified himself with what he saw.

Mick's first week on the salt was August 14 through 20. He arrived on the 12th and on the 14th made his first run in the low 300s. The course was short. There had been no rain all year to smooth the surface by dissolving it and even the scraped portion was not up to normal smoothness; when the salt gets that dry and hard the drag rail tends to bump over the ridges which form over the pressure cracks, instead of erasing them.

Off the dragged portion of the course the surface was littered at each end with the tilted shingles of salt crust that typify a very dry year. Mickey got into this rough area during deceleration. I learned later and not from him that he was taken to nearby Wendover A.F.B. for medical treatment and sedation. He was vomiting and in great pain; the pounding had been very hard on his internal organs.

For his unsuspended car the course was impossible. Mick asked that a new course be dragged and be ready for the second week he had reserved from August 28 through September 3. This was agreed to and he, car and crew returned to Los Angeles.

Mick returned to the Salt during the Nationals and on August 26 turned 354.330 mph, just feeling his car out. A USAC official called Mickey from Los Angeles, told him that his "sanction" had been revoked because of his participation in an outlaw event. Mick counted to ten, then said, "OK, buddy, shove it." He really wasn't that polite. He had run Challenger I in the Nationals the previous season and had not been criticized. If he didn't make an appearance at the Nationals this year he would be accused of having become too self-important to remember his old racing companions. He knew that what he was involved in should be above politics and he shook this irritation from his back. The problem was resolved on his terms. I am not knocking USAC here and in their position would have played the same gambit.

On September 4 huge ponds lay on the salt but Mick was determined to run, if only because his expenses were about $1500 a day. For days he and his crew had been repairing the course by hand, as you fix cracks in plaster with a putty knife; they even worked at night, by automobile headlights. The black line had been washed away so that only a trace remained. A tank truck full of road oil was to have laid a new line the evening of the 3rd. When Mick arrived on the salt at five in the morning of the 4th there was no black line. Atmospheric conditions were ideal for a few hours, then the wind began to come up. At nine a.m. the oil truck became a reality at the south end of the course. Instead of laying the line from south to north and saving the half hour that this would have meant, the truck headed for the north end, to make its start from there. Only it went too far, motored out onto the mud flats and sank to its axles. This sort of luck, if you can call it that, was Mickey's lot day after day. It was absurd, ridiculous, insane and heartbreaking.

It would take half the day to get the 15-ton oil truck out of the mud and Mick, fairly desperate now, elected to run without any guide line. USAC asked for my opinion on this and I assented . . . only in Mickey's case, because of his great driving skill and unique knowledge of the course.

By this time Thompson had reason to feel that all the forces of man and nature were against him – USAC and his sponsors never let him down for a moment – but his luck had been consistently foul for weeks and he was understandably depressed. He taped his leathers around his ankles for fire protection, strapped on his helmet and embraced Judy, his wife, as though this were the final parting. Then he strode over to Fritz Voigt, grabbed his hand and said, "Goodbye, old buddy."

"Goodbye, crap!" Voigt snapped back at him. "I'll see you in ten minutes at the other end!"

Thompson turned 372 mph that trip, ten mph faster than he ever had gone. After that he was a changed man and all the old fighting drive welled back.

Thompson was having slippage problems with his front wheels on that run and suspected his clutches. He took the time to have new Schiefer pressure plates flown in and installed and he added ballast – a heavy, arbitrarily-chosen amount – to the front end. At first his car's handling deteriorated but as he cut the ballast back it improved. Then he tried adding a spoiler to the top of Challenger's nose in an effort to reduce the lift that he suspected. On September 9 Mickey Thompson had the combination and thundered through the USAC clocks at 406.60 mph, to become the fastest motorist in history. On his return run he broke a drive shaft. By the time he had it repaired and was ready to go again all his rivals had fallen by the way. Mick had proved his point quite well and decided to rest for a while on these laurels.

Thompson has driven over 300 miles in excess of 300 mph and over 100 miles in excess of 350 mph. What he has achieved, by his bootstraps, is a story that our State Department might be telling an eagerly receptive world. His entire car is a revolt against orthodoxy and a triumph of intuition. Its shape is "wrong." How do you synchronize precisely 32 throttle butterflies? How do you shift four transmissions through three speeds by moving a single lever in a single plane? And the guts – my God, the guts the man has. Without optimistic illusions, without burning zeal he just perseveres with indomitable determination at the job he has chosen to complete. – *GB*

Soon you'll be able to savor the exciting sounds of these machines in a new record produced by Griff Borgeson and Riverside Records. We've previewed some of the tapes Griff made on the salt and they are highly exciting. – Ed.

(*Continued from page 8*)
and still feeling as completely at ease as if I were driving.

I visited with John again shortly after his first go in the Aston Martins and it was not difficult to sense that the four-wheel sport was already firmly imbedded in his competitive spirit. John's ambitions to point his racing career toward a new and perhaps even more lucrative goal are tempered only by his desire to make the transition at his own pace. However, circumstances have dictated an almost perfect time for him to make the change to racing cars. The only apparent competition (in John's age bracket) now looming on the international scene is McLaren, Gurney, and the brothers Rodriguez. Neither the British, French, Germans or Italians have any young drivers who look particularly promising.

John's motorcycle career, despite its overwhelming success, has restricted his activities primarily to England and Western Europe. Four-wheel racing will extend his travels to South America and the U.S. which will be a welcome change both for John and his close-knit family who have so richly contributed to his numerous successes. I can see no reason why he will not attain World Champion status in cars within the next four years.

Here's hoping that the motorcycling world will be doubly blessed by Geoff Duke's successful return to auto racing in the near future as he has planned. Two "dark horses" who also bear watching are English motor cycle scrambles aces Don and Derek Rickman who have done so well in the recent Cooper Cars driver training classes.

I know that motorcyclists everywhere will be justifiably proud of the successes which these men will surely attain. They are most assuredly a credit to either sport.

Thomas K. McGeachin
Santa Monica, California

WHAT GIVES?

I would like to know why the Type 61 Maserati was not mentioned in the October SCI story on acceleration. The May-June issue of SPORTSCAR GRAPHIC quotes a 0 to 60 time of four seconds for the Type 61 and 4.3 for the 60. What gives?

Dave Roen
El Paso, Texas

We did not quote these figures because we were not able to validate them. It's our opinion that these are very optimistic although perhaps attainable with very low gearing.

CORRECTED PISTON SPEED

As the individual responsible, assisted and abetted by L. H. Pomeroy, late technical editor of the MOTOR, for reviving F. W. Lanchester's concept of the mean piston speed divided by the $\sqrt{s/b}$ as the proper way of expressing the speed of a piston engine, I should like to congratulate SCI on being the first motoring journal to give the value of this expression as a normal routine in road test reports.

F. R. B. King
The Hague, Netherlands

Thank you. For readers interested in the derivation of "corrected piston speed," see Technotes on page 73.

TWO STEAM HORSES

Continued from page 33

prototypes had been built and run; in 1948, when he unveiled the first production 2CV (or *Deux Chevaux Vapeurs*) at the Paris Salon de l'Automobile before the President of the Republic, the President remained tactfully silent. Whimpers of distress from aesthetically-minded Parisians were drowned by the steady tramp of feet and the rustle of check books as the remainder of those present started obediently to form a line.

The directive Boulanger had sent his engineers when the market researchers came back was simple. He wanted "four wheels and an umbrella, capable of carrying a basket of eggs at 40 mph." So the story goes, anyway. In fact it had to carry four people devoid of mechanical sympathy, go anywhere, use practically no gas and cost less than anything else available. The early embryo had front-wheel drive (which wasn't surprising for a Citroën), but there was only one headlamp, the two-cylinder engine was water-cooled and the starter was a piece of string. If you cast your mind back to the day when outboard motors for boats were things you could lift without personal injury, you'll remember how a cord starter worked. The one on the 2CV worked, too, until they tried testing it with a woman on the other end of the cord. Then they reverted to electric starting. The General Director was a six-footer with fixed ideas about the amount of headroom an umbrella ought to have, and he wore a hat. The 2CV's early French perpendicular architecture owes a good deal to that hat; when he could get into any of the four seats without knocking it off, the prototype body was finally passed.

Thus the two steam (fiscal) horses arrived, panting, and by this time air-cooled. Even in early production form the power on the brake was actually nine bhp, the "Two" being an out-of-date fiction on which French taxation is based. The displacement was 23 cubic inches and the maximum speed in favorable conditions was about a millimeter on the right side of 40 mph; acceleration was imperceptible. There is a story which may have started with the Model T but which fits the 2CV so well that the French have adopted it, about an owner who ran out of gas and thumbed a Mercedes for a lift into town. The Merc driver took him in tow but he hadn't gone far when a Jaguar overtook him and roused his competitive instincts. A mile down the road a cafe proprietor looked up, saw the three cars hurtle past and ran to telephone a friend in the next village: "*Mon vieux*, look out of the window. There is a Mercedes racing a Jaguar and behind them a *Deux Chevaux* blowing his klaxon *comme un fou*, trying to get by!"

There wasn't anything fancy about the four-wheeled umbrella, either. Then, as now, it had flat sides for cheapness and a corrugated hood for strength. Instead of cranking down, the bottom half of each front window folds up and out, to clip into position against the top, but if you want more controlled ventilation you can open a hatch right across the car under the windshield, or roll back the fabric top, while warm air from the engine (lukewarm, anyway) still blows onto your feet. After seven years in production, Citroën went so far as to provide an ignition key and door locks, but it wasn't until last Fall that there was an alternative color — and then only one — to battleship gray. The featherweight seats are made of plastic covering over rubber bands which are stretched on a tubular metal frame, and for picnicking or for carrying the kinds of loads that go with moving house all the seats can be taken out in about 10 seconds.

The determined Gaul you see heeling 'round a bend toward you with the accelerator in the ON position is a hard-headed character, and doesn't put up with the curiosities of Citroën ownership for nothing. Today, when the two-year waiting list has come down to a mere six months, gasoline in France costs 78 cents a gallon and an unskilled man earns $125 a month. The price of a new 2CV to a Frenchman is about $970, less than half of what he would have to pay for the DS19, and a new engine if it is ever needed costs $94. The total running costs including repairs and amortization are reckoned at five cents a mile, against six cents for its nearest competitor.

But the thing that has really made the ugly duckling's reputation around the world is the suspension. I won't easily forget meeting the afore-mentioned Gaul approaching us on a washboard road in the fringe of the Sahara, plowing 'round a corner in that familiar down-by-the-bows attitude, oblivious as usual of the awful surface and screwing his accelerator, also as usual, into the floor. After that, and after driving over cobbles and even four-inch curbs in the little beast, you are only faintly surprised to know that the Algerian uranium prospectors have taken Boulanger's hint about the basket of eggs, and use the 2CV for transporting their Geiger counters. The linking of front and back suspensions has been copied subsequently by other manufacturers, but I don't think anyone else has done it with all-independent wheels, one ultra-soft spring connecting them on each side, and inertia dampers that keep the wheels from pattering by matching their motion against that of a 7¾-pound cast-iron lump sliding up and down a cylinder on a coil spring.

The fore-and-aft linkage practically eliminates pitching, and although a 2CV driven energetically is a formidable sight, it takes a lot to make it go off course. Two passengers increase the caster from 14 degrees to 22 degrees positive, a full load stretches the wheelbase by 2¼ inches, and the change in attitude, laden, is such that a knob has to be provided for the driver to set the headlamp beam by hand.

Of course this kind of specification would give anyone itchy feet. A couple of Frenchmen started the circus by driving 'round the Mediterranean. 9,000 miles in 33 days. The next year a pair called Lochon and Cornet covered North America from Quebec to Nicaragua, and South America from Colombia to Tierra del Fuego, the most south-

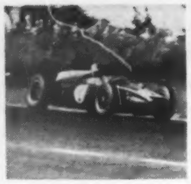
erly point on that continent so far achieved by automobile. On the way they collected an altitude record on the 17,000-foot Mount Chacaltaya in Bolivia — after removing not only the hood, trunk lid and fenders but all the doors and for the last few hundred feet, with the horses gasping on thin air, the passenger as well. In fact sliding the doors off a *Deux Chevaux* (which takes about a minute) is a maneuver that many explorers have practiced, not only for lightening the car but for fording rivers; the river flows through instead of sweeping the car off its wheels.

Lochon and Cornet forded 65 rivers all told, but most of the 2CV's exploits pale before the performance of two French students, Baudot and Seguela, who returned to Paris last year after driving around the world and reported that it wasn't as hard as everybody said. In the course of 50,000 land miles they had one or two memorable moments. After settling down for two or three days' waiting in the Atacama desert of Chile, stuck with no oil in the transmission, they were found in a matter of hours by a peasant who squeezed bananas into the filler hole and confidently sent them 200 miles on their way to the nearest garage. They spent eight days forcing a passage through the Thailand jungle in a search for the bridge on the River Kwai, not knowing that the picture had been made in Ceylon. I'm not sure how much of Seguela's book, now published in France, will get past the American censor, but one of his minor encounters with the United States was losing his shirt on the Las Vegas tables and selling the Citroën's two spare wheels for $10 apiece to a souvenir shop.

There is a *Deux Chevaux* rubbing shoulders with yaks in the Himalayas, where the Maharajah of Sikkim keeps it in place of the big limousine he previously owned; the Norwegian police use it as a breakdown tender inside the Arctic Circle; the Dutch Polder administration has adopted the lightweight for getting about on marshy ground and Dutch police dogs are carried in luxury 2CVs with a foam-lined interior.

There are limits to the places you can go even with a fourteen-horsepower mule (the current engine having been enlarged to a displacement of 26 cubic inches), so a year ago Citroën doubled up. The 4 x 4 is exactly the same as its 2CV running mate except for another engine, driving the back wheels. With twice the power and twice the traction, French oilmen in the Sahara have a new weapon that is claimed to climb a grade of 45 percent.

It's doubtful, for all that, whether American city-dwellers will catch on to the 2CV in large numbers, though they might get a kick out of riding like a Maharajah in a car to give the stylists an uneasy qualm of conscience. If you feel like investing the New York price of 1,300 dollars there is the extra selling point that you won't have much trouble with turnpike speed limits. Baudot and Seguela made their own cruising speed regulator for the U.S. part of their world tour; they tied a brick to a length of string, put the brick on the accelerator and relaxed. As Emile Levassor, the French pioneer and contemporary of Andre Citroën, commented on the crash gearbox of 50 years ago: "It is brutal, but it works." —*RBBS*



WATKINS GLEN

Continued from page 66

frequently at some of the more difficult corners. Brabham came in after a number of laps, and after a brief discussion with John Cooper the decision was made to change gear ratios. The mechanic in charge (in fact, the only one with the Cooper group), a tall thin, beardless lad who looked about 16 years of age, had the gearbox out and sitting in the dust and shale of the pits with a casualness that had to be seen to be appreciated. As background music to all this activity, Gendebien and Bonnier were out on the circuit in the pale-green and red (!) Yeoman Credit cars, busily engaged in posting times competitive with those cut by Moss and Brabham.

With commendable accuracy, the Race Communications Association flag men stopped the first practice session exactly at 12 noon.

As the one o'clock time beep of the Canadian Broadcasting Company vibrated through the p.a. system the second practice session got under way. First out was the light blue Formula 2 Cooper-Climax of Stutz Plaisted, followed by the Francis Bradley Porsche RS-60. At this late date, Moss and company were still searching for the jets that would allow his Climax to sing its song of power all the way around the course. When these were found, Moss went out to cut a few fast ones for the record books. Moss really trying is a sight to warm any heart capable of being stirred by the sight of a racing car in action. With the all-enveloping bodywork of the modern car, it's difficult to see just how hard the driver is working. Moss viewed from the trackside looked like one of those drivers supplied in the little plastic car kits, the ones that end just below the waist. He was motionless and completely devoid of expression. A view into the cockpit from the Kendall Tower through a whopping big telephoto lens loaned by an indulgent, if bored, UP photographer showed him making rapid gear changes and feeding minute corrections into the steering wheel as the Lotus danced in the view-finder through the sweeping bend just past the pits. Not at all the unmoved and unmoving young man that he appeared when hidden by the bodywork. Shortly after this close-up look at Moss in action he returned a time of 1'15.8". This seemed to be the catalyst needed to get the gearbox back into Jack Brabham's "British-racing-green-old-boy" Cooper, and he was soon in action trying to wrest pole position from Moss.

Brabham, at speed, seemed to crouch over the wheel, with a rather fierce expression wrinkling his dark, pleasant features. All this didn't seem to help much, for the best time he could manage was a 1'16", which still guaranteed him a seat with an unobstructed view of the starter. This seemed to satisfy him, for when notified of his time by a pit-signalling John Cooper he brought the car in and put it away for the day.

With the four modern G.P. cars filling the first four positions on the grid for Sunday, the supporting players struggled on to find out how the rest of the cars would be placed for the start. Of interest was Stirling Moss's interest in the new Sadler car, unusual for the complete lack of a transmission. Replete with a new water pump — mounted during the lunch break — the car was closely examined by the young Britisher, who then proceeded to take it out for a few 1'25" laps. Commenting on it afterward, he thought it might be possible for him to get down to about 1'20" with slightly higher-geared steering and less understeer; Peter Ryan, the Sadler driver, was so encouraged by all this that he took the car out and managed a 1'23" — putting him in the third row behind Gendebien. In his efforts to emulate Moss, young Ryan ran into the same problem that used to vex pilots of the pre-war Auto Unions, which the Sadler resembles. On the uphill sweep just after the pit straight Ryan described a graceful set of circles ending in the grass on the outside edge of the track. His next few laps were a little more sedate, but much more effective. Practice ended on a bass note as Peter Murdoch took his almost vintage four-cylinder Connaught chugging around in 1' 57" to garner the last position on the starting grid. It was an interesting looking car, huge in comparison to the F.1 Cooper.

Race day dawned more beautiful than the day before, if that was possible. Keen types were on the way toward the circuit four and five hours before the scheduled 2 p.m. start. By eleven the roads leading to the track were jammed.

As two o'clock approached we stationed ourselves on the roof of the Kendall Tower. From that vantage point we could see a car start to brake hard for the sharp right that leads into the short straight fronting the pits and then follow it almost into the Clubhouse Esses. The unseen portions of the course — examined on foot the day before . . consisted of the Front Straight, the loop and the frightening Chute followed by the kinked Back Straight which leads into the Big Bend, all of which made an interesting 2.3-mile circuit.

Most of the faster drivers went out for a warm-up lap, after which they coasted to a stop in front of the pits. With a minimum of fuss the grid was made up, a five-minute gun was fired, then a three-minute blast. During the last three minutes the crowd was silent and tense, while a considerable number of national anthems floated over the nearby hills. Then the only noise was the time signal on the p.a. system, and the race car engines as the drivers toed them nervously while waiting to catch the first downward movement of the flag.

The fluttering "off" signal could not have moved more than six inches when Brabham, Bonnier, Gendebien, and Moss shot off in that order as though flung from a single, giant steam catapult, followed closely by the new Sadler. In slightly more time than it takes to unwrap a package of cigarettes and get one burning, Brabham was braking for the hard right corner that led into the recently-vacated grid.

He was closely followed by Bonnier, Moss, Genbedien, and Peter Ryan in the Sadler . . . trailing the leaders by a few hundred

yards. On the eighth lap the lead changed as Bonnier used a slow Porsche Carrera as a running block to nip past Jack Brabham.

The Bonnier-Brabham-Moss-Gendebien train continued in this fashion — with never more than a five-second spread between them — until lap 25 when Brabham passed Bonnier and regained the lead. While this was going on among the leaders the rest of the field was having a friendly contest. On lap 19 the new Sadler pitted for attention to an engine breather and rejoined the fray as the leading Yeoman Credit car tallied 23 circuits.

On lap 41 Gendebien began to slow and the gap between Brabham and the rest of the field increased. A little later Harry Entwhistle took his Mk. XV Lotus into the pits for an eight-lap stop. Then, on the 47th lap, action occurred among the leaders when Moss snaked past Brabham into first, a position he never relinquished. In the first four laps after he took the lead Moss increased it by five seconds, and then to eight in the waning laps. At about this time Gendebien was slowing noticeably, and by lap 73 he was out with a broken gearbox. Shortly before, Peter Ryan brought the rear-engined Sadler in for the last time with its Chevrolet engine making terrible clanking noises.

On lap 85 Moss had an eight-second lead over Brabham, while the remaining Yeoman Credit car, in third place, began to wilt. Eight laps later Moss lapped Bonnier in the pale green car, which seemed to put the finishing touches to the already ailing Cooper — for on the 91st lap the bearded Swede parked the car at the side of the track next to the finish line.

In the last 20 laps of the race Brabham had quietly decreased the gap between him and Moss to about four seconds. The leading Lotus had been doing a leisurely 1'18", when notified of the increase in Brabham's velocity. On the very next lap Moss went back to 1'16" and kept pretty much to that time until the finish. Moss accepted the checker from Tex Hopkins with a wave as he sailed by to finish his 230-mile run at an average speed of 105.8 mph.

As the flag went down Bonnier in the Yeoman Credit Cooper and Ryan in the Sadler coasted down the slight hill across the finish with dead engines to finish fourth and ninth respectively. Thirteen of the 17 starters finished. Both Yeoman Credit cars went out with gearbox trouble. The Sadler dropped out with a blown engine, while the Kaback Mk. XV Lotus fell by the wayside with all-over malaise. The Sadler front-engined car (one of his older sports-racing cars) was retired with a fractured brake line, while the F.2 Cooper driven by William Bradley retired for want of a cog.

The Ecurie Ecosse team, consisting of American Paul O'Shea in a D-Jag and Englishman Roy Salvadori in a Cooper Monaco (they really should have put F.1 after the word Monaco — it was that close mechanically to the Formula cars), turned in an unruffled, competent job that earned them third and seventh place in the finishing order.

The weather was right, the racing was fast and without incident and all three factors were enjoyed by the largest Watkins Glen International Formula Libre crowd yet. —*WW*

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SMOG

Continued from page 31

converters weighed 95 pounds (including 25 pounds of catalyst), were 40 inches long, 12 inches wide and eight inches deep. The heat of operation was enough to char a rubber floor mat, and exhaust noise was greater than anything but Hollywood-type mufflers'. Back pressure was noticeable and it's the feeling of GM engineers that it may be impossible to reduce it to that of stock mufflers. A sweet, pungent odor was noticeable in one of the two experimental converters. Despite these drawbacks, General Motors engineers say "the idea of catalytic oxidation appears to be technically feasible . . ." Useful life of the catalyst is about 12,000 miles.

The Ford catalytic converter is slightly larger than a standard muffler, contains 25-30 pounds of catalyst and removes from 60 to 75 percent of unburned hydrocarbons from the exhaust gases during normal traffic conditions. According to Ford Research engineers, "It also performs the muffling function of the standard muffler, although in certain applications additional tailpipe resonators may have to be used." Under present conditions the catalyst (vanadium pentoxide, the most promising of 100 tested) is good for 10,000-12,000 miles of driving when leaded gas is used. Ford engineers hope to get it up to 15,000-20,000 miles with further experimentation. Even though this converter seems to be the most promising of the two of this type so far announced, it too has its drawbacks. For one thing, in its present state of development it costs about $150; for another, additional air must be introduced into the exhaust to assure an oxidizing atmosphere. This might take an air compressor, as was used during the experiments. Other disadvantages: occasional pungent odor from the catalyst, too long a warm-up period and the possible need during extended heavy-duty operation for a bypass to keep the catalyst temperature down.

Of course, these are not the only afterburners in the developmental stage. According to the Air Pollution Foundation there are at least another 18 companies actively engaged in the study or development of afterburners or important components; the majority of these are working on catalytic afterburners, at the ratio of about two to one. It is obvious, then, that the perfect afterburner has not yet been developed. If there were one, the market would be so huge as to stagger the imagination. Seven million afterburners will eventually be needed in the state of California alone! Just think of the potential for an afterburner that's between 90 and 95 percent effective in removing olefinic hydrocarbons, that lasts from a year to five years and that could be sold installed for $50-100. Before you go rushing out to build a prototype in your basement shop, keep the following points in mind:

An afterburner should last at least as long as a comparable muffler. Most mufflers have a life expectancy of about 18 months. If the afterburner costs more than a muffler, it certainly should last longer.

Anyone used to good engine efficiency would not tolerate the addition of a device that would markedly increase back pressure, so that's out. If possible, the afterburner should have *less* back pressure than a standard muffler.

Size and weight are distinct problems. Who wants to carry more weight than need be? And who wants to have something hanging under the chassis of his car that might scrape over every driveway or bump in the road?

Tied into the size and weight, of course, is the effectiveness of the afterburner. If it's too small, it won't be effective (if it's the oxy-catalyst type) and will require too frequent replacement of the pellets (if it's the catalytic converter type).

It will have to be designed in such a way that it can be easily inspected. Once these have been installed, you can bet agencies are going to be set up to make sure the afterburner on your car is functioning correctly. If it's not, it will have to be serviced and this is the next requirement: easy replacement of the catalyst or the spark plug, as the case may be.

In the search for this perfect afterburner, the auto industry and independent sources are bound to come up with other methods for controlling exhaust emission. "Broad research in fuels, combustion and exhaust," says the Automobile Manufacturers Association, voice of the automotive industry, "is going forward intensively. Further improvements in motor vehicle operation may be expected. Such improvements may in time permit new motor vehicles without the use of expensive special devices . . . In the meantime, the industry has been greatly encouraged by a recent finding that crankcase blow-by is a major source of unburned hydrocarbon emissions . . . From 20 to 70 percent of the total unburned hydrocarbon emissions from motor vehicles comes from the crankcase . . ."

Fumes from blow-by are vented to the outside air through a crankcase vent, or they escape through the oil filler neck. The industry will make available, for sale on 1961 cars in the state of California, a relatively simple system of valves and piping that feeds blow-by back into the engine. The return connection will be made between the carburetor and manifold, to avoid gumming up the carb. A spring-loaded valve will prevent excessive flow and a corresponding upset of the proper fuel/air ratio.

Similar devices have been available for many years at the cost of a few dollars. One such is a flexible tube that connects to the crankcase breather cap at one end and to the carburetor air intake at the other. Another version is a tube from the oil filler neck to a fitting that's tapped into the intake manifold. The fitting has a spring-loaded valve that restricts the passage into the manifold when manifold pressure decreases. Such units, says the A. P. C. D., are installed on trucks, buses and on several imports, including Austin, Daimler, Fiat and Mercedes. They are now being tested on fleet cars operated by Los Angeles city and county.

Another method of reducing the nitrogen oxides in auto exhaust is an "exhaust

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(*Continued from page 84*)

recirculator." This unit takes about 15 percent of the exhaust gases back to the carburetor, after cooling them to 75° F. Both the L. A. Air Pollution Control District and the Engineering Dept. of U. C. L. A. have similar systems that are said to reduce the nitric oxide in exhaust gases by 80-90 percent. This naturally produces a leaner fuel/air mixture, which is compensated for to some extent by advancing the spark timing. Much testing has yet to be done and the A. P. C. D. is careful to point out that this work supplements, rather than substitutes for, the work being done on afterburners. The reason for this is that bigger strides can be made in the reduction of olefinic hydrocarbon emissions than of nitrogen oxides; it is known, for example, that a reduction of olefinic emissions on the order of 90 percent would eliminate smog, but it is not known what amount of nitric oxides would have to be curtailed to accomplish the same result.

Though there is considerable controversy over the effect of reducing olefins in gasoline, this is an area of possible change and development. The debate started when the A. P. C. D. recommended that no gasoline be sold in the county if its Bromine Number was over 30 with an eventual reduction (by the end of 1961) to 20. The county Board of Supervisors then adopted this recommendation over the protest of the Air Pollution Foundation, which says "It doesn't matter whether gasoline contains lots of olefins or no olefins at all—the engine, acting as a mobile 'cracking plant,' immediately transforms non-olefinic gas into olefinic exhaust . . . The smog problem cannot be conquered by removing olefins from gasoline." The A. P. C. D. counters with the argument that "Olefins are the most reactive hydrocarbons in producing compounds that irritate the eyes. The olefin content of exhaust is proportionate to the olefin content of the fuel. Conclusion: reducing olefins in fuel will reduce eye irritation." The authoritative Bureau of Mines, however, disagrees with this, saying, "The majority of experimental data from this laboratory shows a slight trend toward decreased olefin emissions with higher olefinic content of the fuel."

Another interesting anti-smog development that was started seven years ago is the Ram Straticharge Combustion System. This was announced early this year by Stanford University as the invention of Ralph M. Heintz of automatic pilot and electronics fame. The heart of the system is in the combustion chamber, which includes a tiny, precombustion chamber where the fuel/air mixture is ignited prior to normal firing in the main chamber. As the fuel in the precombustion chamber is lit and the compression stroke begins, both the burning and unburned fuel are drawn into the regular combustion chamber and are ignited in this lean form. The idea is to get as lean and as nearly complete combustion as possible; it appears to have been accomplished. While the normal engine throws out five percent of its fuel as unburned hydrocarbons, tests have shown that the Straticharge system gets down close to the optimum of 1½ percent. An interesting byproduct is the engine's ability to run on anything from white gas to kerosene mixed with a bit of jet fuel. Of course many more tests will have to be conducted before this system can be put on the market, but it could be an important stride.

So you live in Vandolah, Florida, or Boxelder, Wyoming. How will you be affected by California's smog controls and the industry's installation of them on cars in that state? After all, California is the only state that will require afterburners on cars, isn't it?

The answer, at least for the present, is that it won't affect you very much. Even in California it's going to take at least a year after two smog reducers have been certified by the State Department of Public Health before they will be mandatory on new cars registered in that state. After the same date, any used vehicle that is transferred to a new owner will also have to be equipped with a certified device at the time of transfer. After the second December 31st that follows certification, no used commercial vehicle can be registered unless it too is equipped with an afterburner. The non-commercial vehicles must conform by the third December 31st after certification.

This means that if two devices are certified by, say, February, 1961, that by February, 1962, all those new vehicles being registered in the state must have controls. ("All those" is some 700,000 annually.) But, the used commercial vehicles wouldn't have to comply until they got their 1963 licenses; used non-commercial cars would have until January, 1964.

It might begin to affect you if more states start drumming for afterburners to fight smog. As long as the manufacturers are able to produce cars in different plants scattered around the country, the installation or non-installation of afterburners doesn't create a problem. The manufacturers will install afterburners on a "per order" basis, even for a long time after other states adopt exhaust emission laws. To keep our air clean, it would seem to be a good idea to equip all cars, no matter where they are run.

Naturally, most of the smog work has been concerned with conventional gas engines and Detroit-built cars. How owners of other cars (such as the imports, cars with two-stroke engines and diesels) might be affected, at least in California, is indicated by the action of the new 13-member Motor Vehicle Pollution Control Board. This board has been given the authority to exempt vehicles for which no certified anti-smog device is available and those whose emissions are within specified limits. Also exempted are motorcycles, tractors and antiques.

This is fairly broad exemption, for if there is no certified control that fits your Renault Dauphine, for example, you will not have to have one on the car. It seems unfair to penalize the imports anyway, most of which are of small displacement. The smaller the engine, the less hydrocarbons it pours out, yet the control laws are set up so that exhaust emissions have to be

reduced by 80 percent, *regardless of engine size*. It seems safe to assume that if everyone in the Los Angeles area traded in their cars for others with half the displacement but still drove the same distances, exhaust emissions would be cut in half.

If you have a smoky vehicle, regardless of the cause, you become immediatly suspect of contributing to air pollution. Yet such is not always the case. A two-stroke vehicle contributes more than its share because of the oil it burns in its normal combustion process. No specific controls have yet been set up for two-stroke engines, though the Health & Safety Code regulates the amount of smoke that may come from any source and the Vehicle Code forbids "excessive" emissions. This also extends to cars that run too rich, thereby emitting more unburned hydrocarbons.

You would think then that diesels which belch forth spumes of smoke should be curtailed. Yet they emit mainly aldehydes, which are irritating but of short range and persistence. They emit very little hydrocarbons or carbon monoxide.

Would a possible answer be to convert gasoline-burning engines to butane or liquified petroleum gas? It has been considered. Such engines fall somewhere between the gas engines and diesels in the proportion of unburned hydrocarbons, but it seems to be an impractical solution.

What happens if you visit the state of California after the cars there have exhaust controls? Will you have to stop at the border and have an afterburner installed? It doesn't seem likely, unless you stay there long enough to fall under the registration laws of the state. There is, though, one other possibility if emission controls return blue sky to Los Angeles and the surrounding area. That is that vigilante committees may come knocking at your door in the middle of traffic, asking you to pull into the nearest gas station for a hanging of your car on the rack, to get a custom installation of the newest and best afterburner. It's either that, or a tar-and-feathering right out of town (smog-free town, of course).
—*WW*

IN NEXT MONTH'S SCI:

- '61s From Europe
- Driving the Facellia and Volvo P1800
- Grand Prix B.R.M. Engine cutaway
- Last of the Red-Hot Alfas
- Newest F. Jr., the Eclat Jr.
- Road Testing the Herald-Climax
- Masten Gregory Profile
- On Sale January First

PHIL HILL RELIVES HIS FINEST YEAR

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ment there and managed to get the fire out. By that time, of course, I'd lost an awful amount of time.

After that came Le Mans, where we had that disaster in running out of gas. Actually, the winning car ran out of gas but he was fortunate in being able to coast into the pits and then refuel. The less said about this the better.

The week after was the French G.P. at Rheims, which is very fast. The opening laps were tremendously exciting, Phil, when you were fighting it out with Brabham.

Well, it was strictly a slipstreaming job on both our parts. He had the advantage because he was able to do it much quicker and get a real tow, and it took me quite a while. I had to be quite close, and aim *directly* down the centerline of his car in order to get enough assistance to get up alongside of him to pass. I think for a while there we were changing positions either once or twice a lap. I think both of us were trying to figure out what we were going to do on the last lap! It certainly would have been interesting to see what would have happened.

As it was, we had our first real failures this year in G.P. cars. All three ring and pinions failed, which was probably caused by the fact that our independent-rear-suspension cars get a considerably better hold coming out of a slow turn than last year's cars did. This is also the first time they've been put to a real test with a straight long and fast enough to keep the differential oil temperature high enough to cause a failure. This was quickly remedied, as we already had some huskier rings and pinions.

The next race was Silverstone, and we had no greater luck there this time than we did at the Daily Express race in May. We still had a basic defect in our roadholding that we'd been working on for quite a while this year. We still hadn't licked it, and on certain circuits it made it virtually impossible to do anything without making a monkey of yourself. The best thing Trips and I could have done at Silverstone was to accept our inferior position and drive accordingly, but as it was we both tried to overcome this disadvantage and probably ended up making ourselves look more foolish than anything else.

And then you went to the new Brands Hatch track, which is even less a Ferrari circuit.

Actually, Jesse, now that we know we have no advantage on the straights, there just isn't any such thing as a "Ferrari circuit" any more. Not even Monte Carlo could be further from a "Ferrari circuit" than Brands Hatch, where I finished fourth among Coopers and Lotuses and what-have-you, which is not bad. We tried several different types of front suspension geometry there, and hit pretty close to home. We were quite happy with this new layout, which enabled us to go back to other roll centers in the rear that we had previously discarded as being out of the question.

All these improvements were rather embarrassing to us, you know, because we drivers had all but scrapped the idea of a front-engined car, so we didn't want to influence the engineers with our enthusiasm for these changes, because we *liked* the rear-engined car, you understand? And there are a number of people at the factory that don't particularly want our car to look like the little bugs the others are. They want to keep them in the same classic proportions the racing car has always had — with the engine in the front — so it was with mixed emotions that we greeted these improvements in the roadholding.

One of the most unusual circuits used for a Grande Epreuve *this year was Oporto, with its trolley tracks and cobblestones. How did you like it?*

I'd driven there once before, in a sports car in 1956, and I did *not* like the circuit at all. Anticipating driving there this year, I couldn't recall whether I didn't like the circuit or whether I had a car there that I didn't like very much. At any rate, in the first practice this year all my feelings for the circuit were renewed. I *hated* it. It was so bumpy that it made your eyes blur! The independent suspension gets an unbelievable workout going over these cobblestones.

As time wore on, though, and as we got more accustomed to the circuit, it became easier to deal with. Actually, I really came to enjoy the circuit very, very much. It was quite challenging. That downhill bit with all the trees on the outside is very exciting — and frightening — to drive. I know there are a lot of people who say it's a good sign of a bad car if it handles better when you fill the fuel tanks, and there may be a good bit of truth to that; it was certainly true of ours at Oporto.

In practice, both Trips and I found that the workout the suspension was getting tended to fling the brake pads back into their calipers, which meant that when it came time to apply the brakes they were a fair distance away from the discs, on many occasions. This sometimes meant a full stroke of the pedal before you got any brakes. Well, of course you can't have this condition, so it was always necessary — after we passed any really bad section of road — to use our left foot to pump the brakes back up to get the pads back against the discs so they'd be ready when we needed them. We were actually thrown off a little bit in practice with this, but during the race we were a good bit better off. We had both done a little modifying to the balance of the car with the springs and roll bar and the like, between practice and the race, but to tell you the truth I was very surprised to find myself up there among the leaders — or not very far behind them.

I was particularly surprised in the downhill section, where some of the turns are not cambered nicely, a situation that's been quite bad for us for two years now. It was very rewarding to start down the hill a certain distance behind Moss and Surtees, both driving Lotuses, then come out at the bottom, a few kilometers farther on, approximately the same distance behind.

Then, for some peculiar reason, the bronze piston inside the clutch-operating hydraulic cylinder started to pick up alu-

minum from its housing, and in no time it was making a bad seal between the housing and the rubber cup inside. The clutch began to have a very strange feel. Sometimes it would operate and other times it would just be like a big sponge, then it would sort of be back again; it was difficult to figure what was going on, exactly. I began to miss shifts now and then because I was driving very, very hard and being merciless with the gearbox; one thing was paramount in my mind – that was to keep Brabham behind me.

I kept getting signals from the pits that Brabham was seven seconds behind and then six seconds behind and then five seconds, then I got it back up to seven again, somehow. Finally he came closer and closer and finally he was right behind me. We went around two or three laps like that, then he passed me, coming out onto the ocean front, and immediately I got back by him again at the end of the straight. I decided that *then* I needed to reopen the distance again if at all possible, just to discourage him, but just about that time this clutch started giving trouble.

Right from the beginning I had been leaving my braking until 200 meters before that little square turn that goes between the houses – the slowest one on the circuit – and I missed a gear change. I was driving in a way that everything had to come off exactly right in order to get stopped. To have a proper front-rear braking ratio, our cars were so balanced that you need 8000 revs worth of engine helping at the back wheels, *right then*, and the minute that the revs are down under seven, *bang* you're into the next lower gear to get that 8000 revs hanging on the rear wheels again. If you don't, you'll start locking up the front wheels.

That's exactly what happened to me. I missed the gear change from fourth down to third, and in the fumble I lost just enough deceleration there. I thought I was going to have to go down the escape road, but at the last minute, as I was drawing up to the turn, I thought "somehow I'm going to make it" and I made a try at it – and didn't. I hit the curb. The radiator wrapped around the front suspension, tie rods and steering idlers, and that was that.

Phil, what do you think about this Monza banking? It is rough, isn't it?

Well, it isn't particularly a thing that I like to do, to be perfectly frank, but there's lots of stuff I don't like to do in motor racing. There are lots of stretches of roads and places that I just don't like to negotiate. But I hardly think that because one feels this way a boycott is justified. Actually, I think the English were being a little bit hysterical about the whole thing. Any number of races have been run there; one year Ferrari had some steering rod failures but it didn't seem to result in anything disastrous.

I'm sure that if I were driving on a team where the cars had so little margin of strength that they had failures even on normal roads, I might be frightened to drive on the banking myself! But let's not forget that there were three weeks between Oporto and Monza – certainly enough time to do any additional gusseting or strengthening, *if* they hadn't decided long before that they weren't going to go.

–PH&JA

HURGS WERE FOR HURRYING

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aluminum backplates. They were, as already mentioned, mechanically operated, through cased cables. Position of the engine-gearbox unit on the chassis can be gathered from the fact the radiator shell was a full six inches back from the front axle plane. Vegetable matter being anathema to Godfrey and associates, the engine was insulated from the chassis by the merest wafers of rubber — just enough to prevent direct metal-to-metal contact but not enough to let the rugged Meadows rock visibly under torque reaction.

All the steering pivots and bushings were uncompromisingly metallic. A cam-type steering box was used, geared for 1⅝ turns of the wheel from lock to lock. Remotely controlled and devoid of synchromesh, the gearbox was gated to site the low notch at back left and top at forward right, a reversal of normal practice that took some getting used to. Dry, the car weighed 1568 pounds and, with 50 bhp to propel it, would do the standing quarter-mile in 19.6 seconds.

If, in an earlier reference to invisible springs halfway along the chassis, I gave the impression all H.R.G.'s were jello on wheels, I take back the impeachment. Certainly, skimpily bodied as they were, the Monaco — modified cars raced at Le Mans and elsewhere after the war felt to me as though the midsection of the frame would have benefitted from a couple of splints. The stock models of all vintages, on the other hand, probably were at least as rigid structurally as the contemporary competition. Channels 4½ inches deep, and of the ample gauge Godfrey used, could be depended on to take care of most bending and torsional stresses encountered in the course of normal motoring; if, in extremis, they bent or twisted some (which I think they did and Ron Godfrey thinks they didn't) it was likely because something had to give and the springs wouldn't, or not enough anyway to absorb the full kick.

Be that as it may, the best and truest tribute I can pay the standard H.R.G.s I drove and relished before and after the war is to say they steered and held the road like Bugattis. Typical Bugs handled superbly in spite of flimsy frames, surely because their steering was geometrically correct, highly geared and completely devoid of lost motion. Their unsprung weight was as low as it could be, commensurate with a beam front axle and a live rear one. Their weight distribution was without fault. For the same set of reasons the Hurg was an outstandingly biddable machine. It wasn't a comfortable car, but neither were the contemporaries it's reasonable to compare it with — Aston Martin or Frazer-Nash. Anyway, the H.R.G. slogan called it the Sportsman's Ideal, not the dowager's ideal, and the sportsmen of that fast-receding era had a pronounced streak of masochism.

With its all-metal steering bushings, rigid rod and arm tackle, and far-back engine placement (46/54 front/rear weight distribution in the 1½-liter version), the classic H.R.G. was an extremely hi-fi steerer. As long as you just rested your fingertips on the wheel, straight-line tracking was excellent, but any attempt at wrists-of-steel stuff was resented. In a 1948 road test report, the London MOTOR suggested that, at only two turns from lock to lock, the steering was *lower* geared than it need have been. Prewar, the gearing had been 1⅝ turns from lock to lock, and I remember thinking even this could have been raised without putting any strain on the biceps.

Vis-à-vis Aston Martin and Frazer-Nash, the H.R.G. had three main claims to sportsmen's custom: it didn't suffer from excess weight, like the Aston, nor from crude chain transmission, like the 'Nash, nor from an inflated selling price, like both. Hurgs cost more than the MG Midgets and Magnettes of the day — and of course gave you more engine for your money — and a lot less than Astons and 'Nashes, which were strictly for rich young roustabouts.

Naturally the Tolworth make had its shortcomings but mostly these were the kind Quintilianus classified as *dulcibus vitiis*; among its not-so-sweet faults, on the other hand, was a tendency to break frames. After the British Racing Drivers' Club contested a 12-hour team race against their French counterpart at Montlhéry in 1948, private owner Robin Richards' complacency at scoring second-highest British placement with his 1100 cc H.R.G. — against competition ranging up to 8 liters — was quickly deflated when his frame broke in two on the way home. It was Richards, incidentally, who had earlier won a hard-to-get Coupe des Alpes in the '48 Alpine Rally. Seldom, he confesses retrospectively, had he undergone such a grueling ride as his Sportsman's Ideal gave him in the Alpine.

Another but lesser *dulcibus vitiis* was a difficulty in keeping the brakes equalized. You could take the adjustment up without getting out of the car, true, but only as a four-wheel team collectively, not interrelatively. The hand brake, by the way, operated on all wheels, same as the pedal — a big asset in rally tests.

Ron Godfrey, with his kind of background as designer and constructor, had no reason to regard the H.R.G. as anything but a relatively soft and sybaritic vehicle. His surname initial had been the G in G.N., a truly hairy cyclecar tracing its origins back to 1911. (The N was for Nash, who in due course gave his Christian and surnames both to the Frazer-Nash, which makes the whole thing pretty complicated, I'm afraid.) The G.N. story is a saga in its own right and has no place here, but maybe space can be spared for a single anecdote to throw light on Godfrey's celebrated resourcefulness:

The regular G.N.s were mostly two-seaters, but once in a while a customer would specify a one-place body. One time in 1913 a monocar G.N. was ordered by a fellow who planned to break it in on a continental tour. The day before he was due to take delivery he called the factory and said he'd decided to take a friend along on the projected excursion, so what did they say to that? Undaunted, Ron and his artisan rolled their sleeves up and overnight executed a by-guess-and-by-Godfrey makeover. This involved sawing the chassis in half, bolting an extra 14 inches into the gap and in some extraordinary manner stretching

the body from monoposto to tandem two-place dimensions. It was finished and ready by the time the customer came around next morning. G.N. employees, incidentally, were paid according to stature, real runts receiving a quarter of a penny per hour.

The sole departure from classic open-wheel architecture in H.R.G. history was the short-lived model known as the Aerodynamic, hatched in 1946. With a modern-looking full-width body but still retaining such anachronisms as cart springing and mechanically-operated brakes, the Aerodynamic could be regarded as the automobilious equivalent of the Bible's whited sepulchre; sort of a British-racing-green sepulchre. The body, although made in aluminum alloy, was naturally heavier than the slimmer counterpart, which detracted from performance. Also, these bodies rattled a good deal and sometimes cracked. The Aerodynamic's one real claim to fame was that, in 1948, Hurgs of this type formed the Spa 24-hour team we met in an earlier episode of this tale.

H. R. Godfrey, active and spry at seventy-two in spite of a recent severe illness, is now the only founder member of the H.R.G. Engineering Company who's still associated with it. H.R.G. hasn't made cars since 1956 and is presently engaged in general engineering projects. It also manufactures a very good light-alloy head for the B-series BMC engine and purveys the remaining stocks of Alta s.v.-to-o.h.v. conversion sets for Morris Minors.

Ron Godfrey has a connoisseur's interest in water mills and inhabits one at Bramley, Surrey. An amateur as well as a professional engineer, his mill house contains more workshops than living rooms. When he took possession of Bramley Mill, this sixteenth century collector's piece lacked just one thing — a water wheel. So he made him a new one and generated his own domestic electricity with it. About nine feet in diameter, it's so aquadynamically efficient it rotates at ponderous but seemingly unstoppable rpm when the waterflow is bated to a trickle you could put through a two-inch pipe.

Well-preserved automotive relics, *chez* Godfrey, include an 1100 H.R.G., which he sometimes uses for personal transportation, a 1921 G.N. on which he occasionally attends Vintage Club rallies, and an astonishingly modern-looking V-twin engine he designed for a racing G.N. in 1912. This one has bronze hemispherical heads and 90-degree valves, among other enlightened features. Too honest to claim credit he isn't wholly entitled to, he admits the two-banger's top end was "suggested" by a 27/80 Austro Daimler he'd owned in 1910. Its designer? Ferdinand Porsche.

Forty-four years after picking Porsche's brains for this inclined-valve cranium, Godfrey, with assistance from an associate named S. R. Proctor, perpetrated another hemispherical-headed engine. Announced, but never actually marketed, in 1956, the latterday exercise in better breathing was grafted by H.R.G. onto the main block of the 73 x 89.7 mm (1496 cc) Singer engine the little Tolworth firm had standardized postwar on the Sportsman's Ideal. The head was cast in light alloy, the valves were interangled at 90 degrees, dual camshafts were driven by duplex chains, and the spark plugs were centrally placed. With two twin-throat Solex sidedraft carburetors and a compression ratio of 8.8 to 1, this engine developed 108 bhp at 5750 rpm.

In keeping with such a modern powerplant was a tubular chassis with all-independent suspension, magnesium spider wheels and Palmer disc brakes. Visible in a photograph on page 59 is this chassis' unusual suspension, in which a very wide transverse leaf (5 inches across) handles the main springing chore but is backed up by inclined coil springs and shock absorbers at each corner of the car. The idea behind this was that, if and when you wanted to ring changes on spring strengths and periodicities, it was easier to do so by changing the coils than changing leaves. As can be seen, there were wishbones front and back, Cooper style. As an experiment — which came to nothing because suitable material wasn't commercially available in the right sections — *triangular* springs were tried in place of the wide but parallel-sided leaves. In plan, these triangles corresponded to the outline of the wishbones. It worked extremely well, Godfrey says.

Disappointingly, the whole project fell on its face because, just when production should have started, Rootes acquired Singer and the engine that had been the core of the whole deal went onto the scrap heap. Having already spent $60,000 on developing this second-generation Hurg to the point it had then reached, Godfrey and his co-directors decided prudence was the better part of valor and quit car manufacture altogether. The Sportsman's Ideal of revered memory was dead, and alas, there was no successor to traverse its wheeltracks.

—DM

BRAVISSIMO!

Continued from page 53

car ready in time for practice. Naylor, on the other hand, gamely came to Monza and put up a credible show with his J.B.W. Formula 1 machine but a gearbox failure shortly before the end of the race caused his retirement. Other runners included Cabianca and Munaron in the two Cooper-Castellottis, Scarlatti and Thiele in the Centro-Sud Formula 1 Cooper-Maseratis, Owen in a Cooper-Climax, Seidel and Drogo in Formula 2 Coopers, Gamble in the Behra-Porsche, Wilson in a Formula 2 Cooper-Climax and Barth and Herrmann in two factory Formula 2 Porsches.

Hill, Ginther and Mairesse were detailed to drive the front-engined Formula 1 Ferraris while von Trips was given the rear-engined chassis fitted with a 1.5-liter engine. The rear-engined Ferrari was far less of a compromise than the front-engined cars and was an easy several seconds faster than the Porsches. During practice Trips was towed around once in the slipstream of a Formula 1 car and improved his official training time by four seconds. Chief problem with the Formula 1 cars was the bottoming that they were suffering with full tanks on the banking. Supplementary springs did not eliminate this and Phil simply did not go too fast in the opening laps. Training was boring and, as someone pointed out, resembled a rally check point with one or two cars occasionally flashing past.

The absence of such stars as Moss and Brabham had a noticeable effect on the size of the crowd. Without the two factory Porsches, the race would have been a complete absurdity; they came "to save the race" as Von Hanstein put it, and except for rubber stops plus stiffer springs the single-seaters from Stuttgart were completely normal.

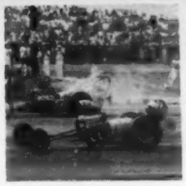
The flag fell shortly after 3 p.m. with Richie Ginther making an especially good start until such time as Phil Hill decided to pass him. Mairesse was detailed to "tow" the Formula 2 Ferrari. This he proceeded to do and the two red cars spent the better part of the race nose to tail. The Porsches gamely did their best but failed to use the Ferrari tactic of getting a tow in someone else's slipstream. When the race was over there were two very disgruntled Porsche drivers plus one very disgruntled team manager — all of the opinion that without the slipstream assist Trips in the F. 2 Ferrari would not have had such an easy time. On one occasion Mairesse broke loose from his job and passed Ginther; a surprised, startled Richie shouted "hey, wait for me" and shot after the Belgian, eventually overtaking him and staying in front to finish second in the demonstration.

All the Maranello drivers regretted the absence of true competition from England. Hill and Ginther especially felt that the dangers of the Monza banking have been strongly exaggerated and point out that on the two occasions when breakage did occur, the shape of the banking allowed the car to slide harmlessly to the bottom (Moss in the Eldorado Maserati in the 500 Miles of Monza) or to coast gently onto the straight and into the pits (Eddie Sachs — same event). Skeptics will probably not accept the fact that no chassis or suspension

failure was caused by the banking this year and cite the relative low average speed as cause. Granted that for the Ferraris the 1960 Grand Prix of Europe was a "stroke job" — to put it bluntly — but was the 131.77-mph average so terribly low?

The rough banking caused the drivers of the front-engined cars to suffer markedly more than Trips in the rear-engined machine. In addition to this, the surface of the banked track rapidly scuffs off during the course of a race and the noses of all the Ferraris were sandblasted; sand found its way into the engine of Hill's car and caused his throttle to stick. He drove the final part of the race on the mag switch. The Ferrari engines were extremely clean after the race and no oil appeared anywhere.

It is my opinion that a modern Grand Prix car should be able to be driven on the Monza banking without falling apart. This in itself is a reasonable test of a car's strength. All credit to the Ferrari drivers for accepting the job given them. *—JLA*



QUICK IN THE QUARTER

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pump 15-20 psi boost on the biggest engines. The smaller 4-71 (280 cubic inches per revolution) gives less "slip loss" or leakage at low rpm, and is favored for torque—though it's too small to boost the big over-400-cubic-inch engines without overwinding.

Frankly, there has been very little development of supercharging systems since last year's Nationals. I expected to see a few examples of two-stage blower installations, intercoolers, maybe a centrifugal blower or two (which are much more efficient than the Roots type), perhaps higher drive ratios and pressures with the GMCs, and maybe higher cylinder compression ratios used with blown engines (since an increase in compression ratio is theoretically just as effective with a blower as without). But I saw none of this. Compression ratios with blowers average around 8 to one, boosts average 12-20 psi, and no two-stage or intercooler layouts were seen. Some fellows had experimented with 10 to one ratios and 25-plus psi boost, but had destroyed engines. In general it looked like the maximum practical *overall* compression ratio (cylinder ratio x blower pressure ratio) might be around 18 to one in the present "state of the art." Thus with the average 8 to 1 cylinder compression this would mean a blower pressure ratio of 18/8 = 2.25 to one, or around 18 psi boost.

One interesting new development was Stuart Hilborn's new 4-barrel fuel injector to mount on top of a 6-71 blower. This has a huge 28.3 square inches of "venturi" area, or twice as much as the old 2-barrel. The reduced restriction is said to add 25 bhp in the 600-bhp range, but throttle response is poor off the line so you have to keep the rpm up. A lot of fellows don't like 'em for e.t., but it is significant that the most powerful single engine at the event—the winning Albertson Olds—used the Hilborn 4-throat injector. This 460-cubic-inch engine dynoed out at just over 650 bhp at 5500 rpm! This was with a 6-71 blower at 1.24 to one drive ratio, 16 psi boost, 8.5 to one compression ratio, Engle 49 cam, and oversize valves. And don't forget that's on pump gas!

You can get more out of supercharged engines by winding 'em up to higher rpm. This is an especially potent method with the smaller engines. Dyno tests show that the peak of the bhp curve is moved upward considerably when a GMC blower is used—and it doesn't seem to drop off as steeply beyond the peak. You can take further advantage of this by using a very long-duration cam. A number of boys were using cams with more than 300 degrees duration on their smaller Chev engines (with quick lift rates and high lift) and turning them 8000-8500 rpm in the gears. They're still pulling like crazy in this range, though it's not likely the actual peak of the power curve is above 7000. They even turn that big 460-inch Albertson Olds 7300 rpm in the traps! This is the way to make 'em go.

(Continued on page 94)

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF Sports Cars Illustrated, published monthly at Chicago, Illinois for October 1, 1960.

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M. T. Birmingham, Jr., Business Mgr.

Sworn to and subscribed before me this 6th day of October, 1960.

(SEAL) William Proehmer, Notary Public. (My commission expires March 30, 1962)

(Continued from page 93)

There were several interesting trends on unblown engines. Compression ratios are creeping up, for one. Guys are learning that a little detonation can be tolerated on these short 13-second runs. (This also applies to blown engines.) You see a number of cars with compression ratios in the 12 to 13.5 to one range. You also see the trend to longer-duration cams and more rpm in the unblown field. There's no respect at all for piston speed. Some of the boys wind their bored-and-stroked 352-cubic-inch Chevs to 7500-8000 rpm, just like the little 283s! This is way beyond the peak of the power curve; but with wide-ratio transmissions this still gives you the highest *average* bhp output over the full course. (The Corvette four-speed box is quite popular in the Gas class, and in this case they don't wind as tight.)

You also see more and more "ram-tuned" intake systems on unblown engines. It's pretty obvious that Chrysler development has triggered a lot of interest in this free horsepower. With Hilborn fuel injectors they mount stacks of various lengths right on the injector bodies. Attempts to tune intake systems using carburetors are more interesting. It is significant that few of the boys attempt to take their tuned length across carb venturis — which Chrysler engineers say isn't practical. Most of them mount the carbs on large plenum chambers, and then take their tuned lengths off the plenum. There may be anywhere from two to eight carburetors feeding the plenum. As for tube lengths, it looks like most of the boys are trying to get their boost near the peak of the power curve, or between 5000 and 6000 rpm. It's pretty hard to find any correlation between the tuned intake systems and good-performing engines, but these kids are certainly on the right track. Give 'em time.

CUTTING WEIGHT

As mentioned earlier, the NHRA drag strip classifying system does not encourage intensive weight reduction, so development lags here. You see a little more aluminum and fiberglass each year, but it's slow. This year two dragsters had their front frame braces bolted to the engine cylinder heads so, in effect, they were using the engine as both a longitudinal and lateral frame bracing member. Light, tubular front axles and wire-spoke motorcycle wheels are more popular. Thinner tubes are being used for frames; .090-inch wall used to be standard, but you see quite a little .060 wall today. Magnesium wheels are practically standard equipment (though I think the guys go for these as much for *looks* as anything else!).

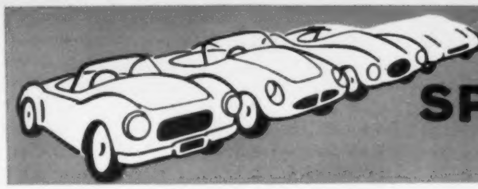
This has all paid off. Six or seven years ago a typical dragster with a little flathead Ford V-8 engine would weigh 1500 pounds dry. Today this is about par for a big 750-pound Chrysler engine with 100-pound supercharger installation. The winning Albertson Olds featured very beefy construction, designed for reliability — and weighed 1650 pounds. On the other hand, Eddie Hill's blown Pontiac-engined car only went 1350 on the scales. Last year the Chev-engined Dragmaster weighed 1180 pounds dry. We *are* progressing on weight.

The rash of twin-engine cars this year was an attempt to get around this problem. The reasoning: you can double the horsepower for an additional 25 percent weight. It worked only on paper. These cars weighed in the 1700-1900 pound range, and some of them undoubtedly delivered over 1000 bhp to the wheels, but it was just too much thrust for the tires to transmit. The rate of torque increase in relation to throttle pedal travel made it virtually impossible to "feather" them off the line, so they just sat and burned while the single-engine cars moved out. Even at the end of the course, at speeds over 150 mph, they couldn't get a bite as the solid-suspension chassis bounced over dips in the strip. (Don't forget it takes less than 800 bhp to break these tires loose at 150 mph.) It would take an extremely smooth strip with excellent traction for these big twin-engine cars to show their stuff. They didn't have a chance at Detroit.

GETTING A BITE

We all know that a rear-drive car will develop its maximum potential accelerating rate from a standing start (assuming sufficient bhp) if it carries virtually 100 percent of its weight on the rear wheels. But there's more to it than just moving weight back on the chassis. When a car accelerates, the inertia reaction force acting at the center of gravity gives a lever effect that lifts weight off the front wheels and dumps it on the rear. The actual percentage of total car weight transferred this way depends only on the instantaneous g. rate, the wheelbase length and height of the c.g. above ground. The greater the g., the shorter the wheelbase and the higher the c.g., the more weight is transferred. (For example at .8 g. acceleration, with 100-inch wheelbase and 22-inch c.g. height, we would transfer about 18 percent of the car weight from front to rear.)

All this sets the stage for some of the weird design trends we saw at Detroit this year. In the first place the NHRA rules require a minimum of 30 percent of the loaded car weight on the front wheels (standing still), to prevent some of the hair-raising "wheel stands" we saw two years ago. But as soon as this rule was passed a few of the sharp boys switched to ultra-short-wheelbase cars to let inertia weight transfer fill the gap. Last year we saw a 79-inch-wheelbase competition coupe at the Nationals that met the 30/70 static distribution requirement, but could lift the front wheels a foot in the air at any point on the course! So for the 1960 season the NHRA set a minimum wheelbase limit of 86 inches. So what's the gimmick now? Higher c.g.s. You see more and more cars with engines mounted higher in the frame, or the whole chassis mounted up 4 to 6 inches higher on the suspension. Some of them look pretty weird — but they *bite*. Meanwhile the trend to shorter wheelbases continues. Many competition cars are now down against the 86-inch limit, and 100 inches is becoming the standard in the street divisions. The '33-'41 Willys coupes are in great demand because you not only get the 100-inch wheelbase, but you have a relatively high c.g. — and there's enough room in the engine compartment to set a big V8 back the allowable 10 per cent of the wheelbase without putting the clutch in the front seat. I was also interested to see several adaptations of small foreign cars in the Gas Coupe/Sedan division. Jack Kulp had managed to wedge a 445-cubic-inch blown Olds engine in a '48 Simca four-door with 95-inch wheelbase! *—RH*



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